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Scientific and Technical Aerospace Reports

A SEMIMONTHLY ABSTRACT JOURNAL WITH INDEXES

THE UNIVERSITY
OF MICHIGAN
JUN 14 1972
REFERENCE

MAY 8, 1972

VOLUME 10 • NUMBER 9

N72-17986—N72-18992

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NATIONAL AERONAUTICS AND SPACE ADMINISTRATION

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Scientific and Technical Aerospace Reports, Volume 10, is prepared by the NASA Scientific and Technical Information Facility operated for the National Aeronautics and Space Administration by Informatics Tisco, Inc.

Use of funds for printing this publication approved by the Director of the Office of Management and Budget March 11, 1971

INTRODUCTION

A COMPREHENSIVE INFORMATION SERVICE

The National Aeronautics and Space Administration makes the results of worldwide research and development activities in aeronautics, space, and supporting disciplines promptly available to participants in its programs. NASA's scientific and technical information system now contains nearly a million documents, which are abstracted, indexed, and obtainable through retrieval and dissemination services. These services, which include this abstract journal, *Scientific and Technical Aerospace Reports (STAR)*, are described in a bulletin, *The NASA Scientific and Technical Information System . . . and How to Use It*, available at no charge from the NASA Scientific and Technical Information Facility, P.O. Box 33, College Park, Maryland 20740.

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Certain publications abstracted in *STAR* are given analytic treatment, with citations and abstracts of daughter items following immediately after the parent document. When the subject content of a daughter differs from that of its parent, a cross-reference citation is printed at the end of the category to which the daughter would normally have been assigned.

Five indexes are included in each issue: subject, personal author, corporate source, contract number, and report/accession number. Cumulative index volumes are published semiannually and annually.

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ABSTRACTS OF NONREPORT LITERATURE

By arrangement between NASA and the American Institute of Aeronautics and Astronautics, the AIAA publication *International Aerospace Abstracts (IAA)* provides parallel coverage of scientific and trade journals, books, and conference papers in the same subject areas as *STAR*. *STAR* and *IAA* are categorized and abstracted in basically identical ways, and documents in both are indexed by terms from the *NASA Thesaurus*. Both journals appear twice monthly, *IAA* being issued on the 1st and 15th of each month.

IAA is available on subscription from the American Institute of Aeronautics and Astronautics. Technical Information Service, 750 Third Avenue, New York, NY 10017, at the following annual rates:

Semimonthly issues: United States and possessions, $110 postpaid; foreign countries, $125 postpaid.

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Scientific and technical reports produced by NASA and its contractors and grantees, or in conjunction with other Government agencies, and other selected documents released by NASA are identified by an asterisk (*) following the accession numbers (e.g., N72-10748*). Prior to their announcement in *STAR*, these NASA publications are assigned a specific NASA report number, which is shown on the last line of the *STAR* citation. The nature of NASA publications is specified by the report number series, identified by a prefix to the report number: TR-R, TN-D, TM-X, TT-F, CR, or SP. These series refer respectively to NASA Technical Reports, which contain significant and complete contributions to scientific and technical knowledge; Technical Notes, reports of similar quality by lesser scope; Technical Memorandums, reports containing preliminary data or of specialized utility; Technical Translations, information published in a foreign language and considered to merit NASA distribution in English; Contractor Reports, information generated under NASA-sponsored contracts, grants, or interagency agreements; and Special Publications, which include conference proceedings, monographs, data compilations, sourcebooks, special bibliographies, and other publications derived from or of value to NASA activities. Reports in these series that are printed by NASA are often referred to as "low numbered" or "low series" publications, because the report number is always below 50,000 (8,000 for Technical Translations). Some TM-X and CR reports are numbered above 50,000. These, and TT-F translations above 8,000, are referred to as "high-numbered" or "high series" publications, and are generally available only in microfiche[1] or facsimile reproductions.

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In the citation of each NASA-supported document and of some non-NASA documents is a code (e.g., CSCL 25A) that indicates the subject category assigned to it from the COSATI Subject Category List (first ed. December, 1964) published by the Committee on Scientific and Technical Information of the Federal Council for Science and Technology.

INDEXING VOCABULARY

The Preliminary Edition of the *NASA Thesaurus* (December 1967) (NASA SP-7030) is used as the authority for the indexing vocabulary that appears in the subject index. The *NASA*

Thesaurus should be consulted in examining the current indexing vocabulary, including associated cross-reference structure. Only the subject terms that have been selected to describe the documents abstracted in this issue appear in the subject index. Copies of the *NASA Thesaurus* may be obtained from the National Technical Information Service or the U.S. Government Printing Office at $8.50 for the three-volume set. The first two volumes of this Thesaurus, consisting of the alphabetical listing of subject terms (A–Z), have been superseded by the following single-volume publication: *NASA Thesaurus Alphabetical Update* (September 1971) (NASA SP-7040), available from NTIS for $6.00. (Volume III of the Preliminary Edition consists of the following ancillary aids to vocabulary selection: heirarchical display of index terms, category term listing, permuted index, and a listing of postable terms only.)

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Denver, Colorado 80225

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Postfach 880
Federal Republic of Germany

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Includes aerodynamics of bodies, combinations, internal flow in ducts and turbomachinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 32 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

02 Aircraft 1147
Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc.; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

03 Auxiliary Systems 1153
Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines; hydraulic, pneumatic and electrical systems; actuators; and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

04 Biosciences 1155
Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

05 Biotechnology 1160
Includes life support systems, human engineering; protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

06 Chemistry 1164
Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

07 Communications 1167
Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

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08 Computers 1172
Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

09 Electronic Equipment 1175
Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors, integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

10 Electronics 1178
Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

11 Facilities, Research and Support 1180
Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

12 Fluid Mechanics 1183
Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

13 Geophysics 1188
Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

14 Instrumentation and Photography 1201
Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders, transducers; aerial photography; and telescopes and cameras.

15 Machine Elements and Processes 1209
Includes bearings, seals, pumps, and other mechanical equipment; lubrication, friction, and wear; manufacturing processes and quality control; reliability; drafting; and materials fabrication, handling, and inspection.

16 Masers 1215
Includes applications of masers and lasers. For basic research see: 26 Physics, Solid-State.

17 Materials, Metallic 1217
Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

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18 Materials, Nonmetallic 1222
Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

19 Mathematics 1226
Includes calculation methods and theory; and numerical analysis. For applications see specific categories. For related information see also: 08 Computers.

20 Meteorology 1228
Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

21 Navigation 1232
Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

22 Nuclear Engineering 1236
Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

23 Physics, General 1236
Includes acoustics, Cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics, 20 Meteorology, and 29 Space Radiation.

24 Physics, Atomic, Molecular, and Nuclear 1239
Includes atomic, molecular and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

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Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

26 Physics, Solid-State 1244
Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

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Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

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28 Propulsion Systems 1248
Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

29 Space Radiation 1252
Includes cosmic radiation; solar flares; solar radiation; and Van Allen radiation belts. For related information see also: 13 Geophysics, and 24 Physics, Atomic, Molecular, and Nuclear.

30 Space Sciences 1255
Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbits and trajectories. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

31 Space Vehicles 1260
Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

32 Structural Mechanics 1266
Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

33 Thermodynamics and Combustion 1271
Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

34 General 1277
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TYPICAL CITATIONS AND ABSTRACTS

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NASA ACCESSION NUMBER

TITLE

AUTHORS

CONTRACT OR GRANT

REPORT NUMBERS

N72-10043'# Boeing Co., Wichita, Kans.
STUDY AND DEVELOPMENT OF ACOUSTIC TREATMENT FOR JET ENGINE TAILPIPES
M. D. Nelson, L. L. Linscheid, B. A. Dinwiddie, III, and O. J. Hall, Jr. Washington NASA Nov. 1971 66 p refs
(Contract NAS1-9622)
(NASA-CR-1853; D3-8535) Avail: NTIS CSCL 01B

A study and development program was accomplished to attenuate turbine noise generated in the JT3D turbofan engine. Analytical studies were used to design an acoustic liner for the tailpipe. Engine ground tests defined the tailpipe environmental factors and laboratory tests were used to support the analytical studies. Furnace-brazed, stainless steel, perforated sheet acoustic liners were designed, fabricated, installed, and ground tested in the tailpipe of a JT3D engine. Test results showed the turbine tones were suppressed below the level of the jet exhaust for most far field polar angles. Author

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PATENT CITATION

NASA CASE NO.

U.S. PATENT CLASS NUMBERS

N72-12440* Auburn Research Foundation, Inc., Ala.
LASER COOLANT AND ULTRAVIOLET FILTER Patent
John R. Rasquin and Fred R. McDevitt, inventors (to NASA) Issued 13 Jul. 1971 14 p Filed 2 Oct. 1969 Supersedes N70-22250 (08-09, p 1645
NASA-Case-MFS-20180; US-Patent-3,593,194; US-Patent-Appl-SN-863276; US-Patent-Class-331-94.5; US-Patent-Class-350-1; US-Patent-Class-350-312) Avail: US Patent Office CSCL 20E

U.S. PATENT NO.

PATENT APPLICATION CITATION

N72-10432*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DIATOMIC INFRARED GASDYNAMIC LASER Patent Application
Robert L. McKenzie, inventor (to NASA) Filed 26 Apr. 1971 14 p
(NASA-Case-ARC-10370-1; US-Patent-Appl-SN-137391) Avail: NTIS CSCL 20E

U.S. PATENT APPLICATION SERIAL NO.

PRIMARY ANALYTIC CITATION AND ABSTRACT

PLACE OF PUBLICATION

N72-10856*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
THE GEMINI PROGRAM: PHYSICAL SCIENCES EXPERIMENTS SUMMARY
Edward O. Zeitler, comp. and Thomas G. Rogers, comp. (ITT Federal Electric Corp. Houston, Tex.) Sep. 1971 554 p refs
(NASA-TM-X-58075) Avail: NTIS HC $6.00/MF $0.95 CSCL 22C

Results and findings of physical sciences experiments performed in the Gemini program are presented. The summary contains descriptions of selected studies in the fields of astronomy, navigation, radiation, geophysics, meteorology, photography, and communications. For individual titles, see N72-10857 through N72-10891.

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Elliott C. Morris *In* NASA. Manned Spacecraft Center The Gemini Program: Phys. Sci. Expt. Sum. Sep. 1971 p 71-75
(See N72-10856 01-30)
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VOLUME 10 NUMBER 9 / MAY 8, 1972

Scientific and Technical Aerospace Reports

A Semimonthly Publication of the National Aeronautics and Space Administration

01 AERODYNAMICS

Includes aerodynamics of bodies, combinations, internal flow in ducts and turbo machinery; wings, rotors, and control surfaces. For applications see: 02 Aircraft and 31 Space Vehicles. For related information see also: 12 Fluid Mechanics; and 33 Thermodynamics and Combustion.

N72-17986# National Aerospace Lab., Tokyo (Japan).
MEASUREMENTS OF DYNAMIC STABILITY DERIVATIVES IN A SUPERSONIC BLOWDOWN WIND TUNNEL
Kazuaki Takashima, Seizo Sakakibara, and Hideo Sekine Jul. 1971 22 p refs In JAPANESE; ENGLISH summary
(NAL-TR-244) Avail: NTIS

Longitudinal dynamic stability derivatives of several airplane configuration models at Mach numbers from 1.5 to 2.25 and also two rocket configuration models at Mach numbers from 1.5 to 3.0 were measured by the forced oscillation technique in supersonic blowdown wind tunnel. The static stability derivatives measured by the dynamic test coincided with those measured by the static test. On the other hand, the dynamic stability derivatives, dependent on the length of the forebody, showed themselves to be of fairly large value compared with calculated ones. In addition to the test results, some details of the test equipment, calibration techniques and error analysis for the data reduction system are included. It is shown by this error analysis, that, as the output of the balance is decomposed by the resolver into static and dynamic components, the latter is very much influenced by the former and that the interference factor can be obtained by test data under wind off conditions. Damping derivatives in the roll of the same models in the same Mach number range are also obtained by the small-amplitude forced oscillation technique or the forced rotation technique. Results of the forced rotation method agree precisely with calculated values. Author

N72-17987*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
LARGE-SCALE WIND-TUNNEL INVESTIGATION OF A V/STOL TRANSPORT MODEL WITH PODDED LIFT FANS FORWARD AND AFT OF A LOW MOUNTED WING
Leo P. Hall and Jerry V. Kirk Feb. 1971 60 p refs
(NASA-TM-X-62102) Avail: NTIS CSCL 01A

A configuration with outboard pod mounted front fans and rear fans located in the wing trailing-edge and fuselage juncture might have superior induced lift and variation of moment with airspeed. A large scale investigation of this type of configuration was conducted in 40- by 80-foot wind tunnel. The model used was a low wing transport representative of currently operating aircraft. Two lift fans were placed in pods forward of and below the wing with the fan centerline near mid semi-span. Two rear fans were mounted at the wing trailing-edge close to the fuselage with the fan rotor in the wing chord plane. Fan performance was measured statically and with forward speed, and longitudinal aerodynamic characteristics were obtained with the fans operating at various tip-speed ratios. Author

N72-17988*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
FORTRAN PROGRAM FOR CALCULATING VELOCITIES IN THE MERIDIONAL PLANE OF A TURBOMACHINE 1: CENTRIFUGAL COMPRESSOR
Michael R. Vanco Washington Mar. 1972 57 p refs
(NASA-TN-D-6701; E-6592) Avail: NTIS CSCL 20D

The program will determine the velocities in the meridional plane of a backward-swept impeller, a radial impeller, and a vaned diffuser. The velocity gradient equation with the assumption of a hub-to-shroud mean stream surface is solved along arbitrary quasi-orthogonals in the meridional plane. These quasi-orthogonals are fixed straight lines. Author

N72-17989*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
APPLICATION OF A ONE-STRIP INTEGRAL METHOD TO THE UNSTEADY SUPERSONIC AERODYNAMICS OF AN INCLINED FLAT SURFACE
Robert M. Bennett Washington Mar. 1972 56 p refs
(NASA-TN-D-6644; L-8047) Avail: NTIS CSCL 01A

The method of integral relations is applied in a one-strip approximation to the perturbation equations governing small motions of an inclined, sharp-edged, flat surface about the mean supersonic steady flow. Algebraic expressions for low reduced-frequency aerodynamics are obtained and a set of ordinary differential equations are obtained for general oscillatory motion. Results are presented for low reduced-frequency aerodynamics and for the variation of the unsteady forces with frequency. The method gives accurate results for the aerodynamic forces at low reduced frequency which are in good agreement with available experimental data. However, for cases in which the aerodynamic forces vary rapidly with frequency, the results are qualitatively correct, but of limited accuracy. Calculations indicate that for a range of inclination angles near shock detachment such that the flow in the shock layer is low supersonic, the aerodynamic forces vary rapidly both with inclination angle and with reduced frequency. Author

N72-17990*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
SPLITTING SUPERSONIC NOZZLE FLOW INTO SEPARATE JETS BY OVEREXPANSION INTO A MULTILOBED DIVERGENT NOZZLE
Ronald G. Huff and Donald E. Groesbeck Washington Mar. 1972 55 p refs
(NASA-TN-D-6667; E-6640) Avail: NTIS CSCL 20D

Air flowing from a convergent nozzle at pressure ratios greater than 2.5 has been split into eight separate jets by overexpansion of the flow into a divergent, eight-lobed passage. The splitting of the flow is accompanied by a decrease in the nozzle axial centerline Mach number. This in part is due to the radial inflow of secondary air between the lobes toward the nozzle centerline. Each of the smaller jets is partially split after it leaves the end of the divergent lobed section of the nozzle, thus creating a velocity profile having 16 peaks. At a pressure ratio of 3.5 the flow decelerates to Mach 1 in three convergent nozzle throat diameters. Convergent nozzle flow normally requires 12 diameters to reach Mach 1. The nozzle has a sound attenuation of 12 decibels with a thrust loss of 9 percent for the best configuration tested. Author

N72-17991# Royal Aircraft Establishment, Farnborough (England).

MEASUREMENTS OF STEADY LOAD ON A T-TAIL FLUTTER MODEL

D. A. Drane, R. Gray, and Irene A. Levett Feb. 1971 20 p refs
(RAE-TR-71035; BR-24880) Avail: NTIS

An experiment to measure steady lift loads on a T-tail flutter model is described. The method of test has been adapted from a technique used for measuring loads on air craft in flight. A way of correcting the measurements has been devised. The measurements obtained are shown to explain a discrepancy hitherto observed between experimentally obtained and calculated flutter speeds. Author

N72-17992# Cranfield Inst. of Technology (England). Dept. of Aerodynamics.

THE EFFECT OF LIFT SYSTEM AIRFLOW ON THE HULL AERODYNAMICS OF HOVERCRAFT

E. J. Andrews Aug. 1971 55 p refs Sponsored by Min. of Technol.
(Cranfield-Aero-7) Avail: NTIS

The influence of aerodynamic characteristics on the handling qualities of amphibious hovercraft was considered. Aerodynamic characteristics of related hovercraft shapes, the effect of cushion efflux on external aerodynamic characteristics, and the effects of lift system airflow and location of induction ports on the aerodynamic characteristics of hovercraft hulls are included. It was established that no major effects of consequence exist. However certain measures can be taken during the design stages of hulls, skirts, and induction ports which will minimize inherent adverse characteristics. Author

N72-17993# National Aerospace Lab., Amsterdam (Netherlands).

A SURVEY OF TEN YEARS OF NLR ACTIVITIES ON RINGWING-BODY CONFIGURATIONS, 1956-1966

S. F. Erdmann and P. J. Zandbergen [1967] 84 p refs
(NLR-TR-69070-U) Avail: NTIS

A survey is given of ten years of activities in designing and testing low drag ringwing-body combinations. Theoretical work is discussed, based on the linearilzed theory as well as on the more exact theory and their implications for the design of an optimum ringwing-body combination. A number of interesting investigations on the effects of base drag, boundary layer displacement thickness and lift are also considered. Measurements on a stylized configuration demonstrate that at low velocities the wing only begins to stall at 20 deg incidence and that in the transonic region the blockage phenomena between body and wing are in approximate agreement with those to be expected from the application of one-dimensional theory. The results of the experimental investigation of the behavior under off-design conditions, i.e. Mach number and incidence differing from their design values, indicate that a pronounced minimum exists at design conditions. Author

N72-17994# California Univ., San Diego. Inst. for Pure and Applied Physical Sciences.

RESEARCH IN RADIATION PHYSICS AND AERODYNAMICS Annual Technical Status Report, 1 Nov. 1970 - 31 Oct. 1971

D. B. Olfe 31 Oct. 1971 20 p refs
(Contract DA-ARO(D)-31-124-257; ARPA Order 570)
(AD-732893; AROD-5133-371-P) Avail: NTIS CSCL 20/4

Contents: Turbulence; Shock tube; Molecular beams; Ionospheric physics; Laser physics. GRA

N72-17995# Naval Weapons Center, China Lake, Calif.

COMPUTATION OF CAPTIVE FLIGHT LOADS ON AIR CARRIED WEAPONS

J. W. Onstott and W. J. Werback Sep. 1971 103 p refs
(AD-733673; NWC-TP-5235) Avail: NTIS CSCL 01/3

A computer program for calculating airborne store loads, shears, and moments is described. Three hanger configurations can be treated: two lugs and four sway braces; a statically determinate two-hanger rail-launch; two T-lugs with no sway braces. The program automatically calculates lug and sway brace reactions. Shear and moment distributions are plotted and tabulated for the vertical, lateral, and resultant loads. Expanded capabilities of this program also permit determination of the effect of varying cant orientation angles of the store with the same bomb rack geometry. A new feature is a quick-look calculation using a standard set of load factors from the captive flight, catapult takeoff, and arrested landing load factor curves. Author (GRA)

N72-17996# Texas Univ., Austin. Dept. of Aerospace Engineering and Engineering Mechanics.

SUMMARY OF RESEARCH ACCOMPLISHMENTS, 1 DEC. 1966 TO 30 NOV. 1970 Final Report

Ronald Stearman Jan. 1971 32 p
(Grant AF-AFOSR-1234-67; AF Proj. 9782-01)
(AD-733370; AFOSR-71-2895TR) Avail: NTIS CSCL 01/3

A combined theoretical and experimental research program has been carried out over the past four years to establish preliminary design criteria for estimating the aeroelastic stability and forced-response characteristics of thin-walled circular cylindrical shell structures. As a result of this study, several basic observations were made concerning the degree of sophistication required in the aerodynamic and structural modeling of this aeroelastic problem. It was found, for example, that small details in the description of the structural boundary conditions can strongly influence the aeroelastic stability of the shell. The most significant structural boundary condition effect was observed when the shell geometry and loading conditions were such that the edge disturbances were propagated well into the interior of the shell. On the other hand, when conditions were such that these edge disturbances were confined to a small boundary layer region near the ends of the shell no significant edge effects were noticed on the overall shell aeroelastic stability. Small initial deviations of the shell's surface from its idealized shape were also shown to drastically reduce its resistance to panel flutter even though the deviations were only on the order of one shell thickness. Panel flutter instabilities in the presence of a laminar boundary layer profile were also found to be much less destructive to the shell than those originating in the presence of a turbulent profile. Author (GRA)

N72-17997# Office of Naval Research, London (England).

THIRTEENTH ANNUAL ISRAEL CONFERENCE ON AVIATION AND ASTRONAUTICS

Richard D. Mathieu 18 Oct. 1971 11 p Conf. held at Tel Aviv and Haifa, Israel, 3-5 Mar. 1971
(AD-733400; ONRL-C-20-71) Avail: NTIS CSCL 01/2

The Thirteenth Annual Israel Conference on Aviation and Astronautics was held during the period 3-5 March 1971. The titles and authors of the papers presented are listed. Papers covered the general areas of applied aerodynamics, experimental methods in aeronautics, aircraft structures, flight mechanics, and rocket engines. The invited lectures on wide body jet aircraft, rocket engines, and the Apollo program are summarized. Author (GRA)

N72-17998# Flight Dynamics Research Corp., Burbank, Calif.
HIGH L/D SUPERSONIC LIFTING SYSTEMS Final Report, Jan. - Jul. 1971
Morton Alperin Wright-Patterson AFB, Ohio AFFDL Jul. 1971 56 p refs
(Contract F33615-71-C-1297; AF Proj. 1366)
(AD-731566; TR-71-07-01; AFFDL-TR-71-99) Avail: NTIS CSCL 20/4

The system investigated is comprised of two elements whose shape and relative position create a beneficial interference effect similar to that achieved by swept wings. The particular geometry of the Compound System is investigated for the capability of recovering loss in L/D resulting from the airfoil thickness without the favorable interference effect. Although the basic concept was conceived in terms of triangular shaped airfoils with interfering shock waves which interacted with the airfoil boundary layers, the information derived from this simplified analysis has been utilized to derive airfoil shapes to accomplish the desired effect without undesirable shock boundary layer interactions. Author (GRA)

02 AIRCRAFT

Includes fixed-wing airplanes, helicopters, gliders, balloons, ornithopters, etc; and specific types of complete aircraft (e.g., ground effect machines, STOL, and VTOL); flight tests; operating problems (e.g., sonic boom); safety and safety devices; economics; and stability and control. For basic research see: 01 Aerodynamics. For related information see also: 31 Space Vehicles; and 32 Structural Mechanics.

N72-17999+ National Center for Atmospheric Research, Boulder, Colo.
AEROSTATIC LIFT OF HELIUM AND HYDROGEN IN THE ATMOSPHERE
J. C. Warren, J. H. Smalley, and A. L. Morris Dec. 1971 82 p refs Sponsored by NSF
(NCAR-TN/IA-69) Avail: NTIS

The table of Aerostatic Lift of Helium and Hydrogen in the Atmosphere is presented. The original report was expanded to include lower pressures than were previously available and data were added to give mass of air above specified pressure levels. A discussion of the buoyancy of lift gases is presented. The relationships among pressure, temperature, density, and height are discussed. The properties of the U.S. Standard Atmosphere, 1962, are discussed and equations are given for generating the values. Deviations from the standard model atmosphere and examples of the use of the Table are included. Author

N72-18000*# Scientific Translation Service, Santa Barbara, Calif.
DEVELOPMENT OF SUPERSONIC AIRCRAFT COMPONENTS OF FLIGHT SAFETY
I. Kumkov Washington NASA Feb. 1972 11 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya (Moscow), no. 10, Oct. 1970 p 10-11
(Contract NASw-2035)
(NASA-TT-F-13952) Avail: NTIS CSCL 01B

The Tu-144, the Soviet supersonic aircraft, was test-flown in December of 1968 and the time when the first passengers will appear in the luxurious compartments of this swift giant is near. Problems are going to be faced by pilots when the supersonic aircraft start regular service. Radically new factors are going to be present in the organization and execution of flights, and in the methods of air traffic control. These and others questions are considered. Author

N72-18001*# Hydrospace Research Corp., San Diego, Calif.
NOISE REDUCTIONS ACHIEVED ON A 720-023B AIRCRAFT USING A TWO-SEGMENT APPROACH
Ray E. Glass Dec. 1971 88 p refs
(Contract NAS2-6490)
(NASA-CR-114417; HRC-TR-S-205) Avail: NTIS CSCL 01B

A flight investigation to determine the operational feasibility of two-segment approaches as a means for reducing airport community noise has been conducted. The effective perceived noise level (EPNL) associated with these approach profiles, using a 720-023B jet aircraft, has been obtained. The tests were designed to determine an operationally optimum approach profile and to quantify the reduction in noise level at predetermined locations on the ground beneath the flight track. The acoustic aspects of the test program are examined. An analysis of the optimum and reference profiles was made using a group of pilots. Information was also obtained on the types of pilot operational procedures used for the optimum profile. Author

N72-18002# National Transportation Safety Board, Washington, D.C.
AIRCRAFT INCIDENT REPORT: NORTHEAST AIRLINES, INCORPORATED, MCDONNELL DOUGLAS DC-9-31, N982NE, MARTHA'S VINEYARD, MASSACHUSETTS, 22 JUNE 1971
29 Dec. 1971 18 p
(NTSB-AAR-72-4) Avail: NTIS

On June 22, 1971, a DC-9-31 aircraft struck the water during a nonprecision instrument approach and received minor damage. There were no injuries to the three passengers and five crewmembers aboard the aircraft. The flight was performing a VOR straight-in approach to Runway 24 at Martha's Vineyard at the time of the incident. The aircraft struck the water approximately 3 miles short of the runway. Minor structural damage was incurred by the lower aft section of both engines. The probable cause of this incident was the lack of crew coordination in monitoring the altitude during the performance of a nonprecision instrument approach, the misreading of the altimeter by the captain, and a lack of altitude awareness on the part of both pilots. Author

N72-18003*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
EXPLORATORY FLIGHT INVESTIGATION OF AIRCRAFT RESPONSE TO THE WING VORTEX WAKE GENERATED BY JET TRANSPORT AIRCRAFT
William H. Andrews, Glenn H. Robinson, and Richard R. Larson Washington Mar. 1972 32 p
(NASA-TN-D-6655; H-671) Avail: NTIS CSCL 01B

The effect of intercepting wing tip vortices generated by large jet transports, including jumbo jets, over separation distances from 1 nautical mile to 15 nautical miles is evaluated on the basis of the response of a vortex probe airplane in the roll mode. The vortex probe test aircraft included a representative general aviation airplane, an executive jet, a fighter, and light and medium weight jet transports. The test conditions and airplane configurations were comparable to those normally used during takeoff, landing, or holding pattern operations. For flight safety the tests were performed at altitudes from 9500 feet to 12,500 feet. In addition to an evaluation of the probe airplane response, a flight test technique is suggested for determining minimum separation distance, using as variable the ratio of vortex-induced roll acceleration to maximum lateral control acceleration and the gross weight of the generating aircraft. Author

N72-18004*# Hamilton Standard, Windsor Locks, Conn.
ADVANCED GENERAL AVIATION PROPELLER STUDY
Rose Worobel and Millard G. Mayo 21 Dec. 1971 54 p refs
(Contract NAS2-6477)
(NASA-CR-114399) Avail: NTIS CSCL 01C

Methods for predicting the performance, noise, weight, and cost of propellers for advanced general aviation aircraft of the 1980 time period were developed and computerized. This basic program was refined to incorporate a method of including the blade shape parameter, integrated design lift coefficient. This method and a reverse thrust computational procedure were

included in the computer program. The weight equation was refined and also incorporated in the computer program. A User's Manual which includes a complete listing of this computer program with detailed instructions on its use has been written.
Author

N72-18005*# Boeing Co., Philadelphia, Pa. Vertol Div.
AN EXPERIMENTAL INVESTIGATION OF THE HELICOPTER ROTOR BLADE ELEMENT AIRLOADS ON A MODEL ROTOR IN THE BLADE STALL REGIME
Richard K. Fisher, Jr., Jerome E. Tompkins, Christopher J. Bobo, and Richard F. Child Sep. 1971 120 p refs
(Contract NAS2-5473)
(NASA-CR-114424; D210-10347-1) Avail: NTIS CSCL 01B

A wind tunnel test program was conducted on an eight foot diameter model rotor system to determine blade element airloads characteristics in the unstalled and stalled flight regimes. The fully articulated model rotor system utilized three blades with a Vertol 23010-1.58 airfoil section, the blades being 1/7.5 scale models of the Ch-47C rotor blades. Instrumentation was incorporated at the blade 75% radial station to measure pressure and skin friction distributions, surface streamline directions and local angle of attack. The test program was conducted in three phases; non-rotating, hover and forward flight at advance ratios of 0.15, 0.35 and 0.60. Test data were analyzed with respect to providing insight to the mechanisms affecting blade stall, particularly retreating blade stall during forward flight conditions. From such data, an assessment was made as to the applicability of current theoretical analyses used for the prediction of blade element airloads in the stall regime.
Author

N72-18006# National Center for Atmospheric Research, Boulder, Colo.
PERFORMANCE OF HIGH ALTITUDE BALLOONS
Frank Kreith (Colorado Univ.) Jul. 1971 139 p refs
Sponsored by NSF
(NCAR-TN/STR-65) Avail: NTIS

The development of a computer designed to predict the vertical motion of a balloon based on heat transfer coefficients and friction coefficients is discussed. The three general areas in which thermal design can improve balloon operation are presented. The equations governing the vertical motion of the balloon are described. The complete computer program for predicting the balloon performance is included.
P.N.F.

N72-18007*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
AERODYNAMIC CHARACTERISTICS OF A SIX-JET V/STOL CONFIGURATION WITH FOUR SWING-OUT LIFT JETS IN THE TRANSITION SPEED RANGE
Arthur W. Carter Washington Nov. 1970 191 p refs
(NASA-TM-X-2060; L-7246) Avail: NTIS CSCL 01A

A wind-tunnel investigation has been made of the longitudinal aerodynamic characteristics and jet-interference effects of a model of a jet V/STOL variable-sweep fighter airplane that employs four direct-lift engines which swing out from the fuselage and two lift-cruise engines located in the rear part of the fuselage. Data were obtained with two wing areas for various forward speeds and power conditions in the transition speed range. The data are presented without analysis or discussion.
Author

N72-18008*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
EFFECTS OF GROUND PROXIMITY ON THE AERODYNAMIC CHARACTERISTICS OF A SIX-JET V/STOL CONFIGURATION WITH FOUR SWING-OUT LIFT JETS
Arthur W. Carter Washington May 1971 225 p refs
(NASA-TM-X-2212; L-7555) Avail: NTIS CSCL 01B

A wind-tunnel investigation has been made of the effects of ground proximity on the longitudinal and lateral-directional aerodynamic characteristics and jet-interference effects of a model of a jet V/STOL variable-sweep fighter airplane that employs four direct-lift engines which swing out from the fuselage ahead of the wing and two lift-cruise engines located in the rear part of the fuselage. Data were obtained through a range of angles of attack and sideslip at simulated speeds from hover through transition at various heights of the model above a moving-belt ground plane. Power-off data and power-on data at several power conditions are presented. The data are presented without analysis or discussion.
Author

N72-18009*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
METHODS FOR REDUCING POLLUTANT EMISSIONS FROM JET AIRCRAFT
Helmut F. Butze 1971 16 p refs Presented at 92d Winter Ann. Meeting of ASME, Washington, D. C., 28 Nov.-2 Dec. 1971
(NASA-TM-X-68000; E-6762) Avail: NTIS CSCL 01B

Pollutant emissions from jet aircraft and combustion research aimed at reducing these emissions are defined. The problem of smoke formation and results achieved in smoke reduction from commercial combustors are discussed. Expermental results of parametric tests performed on both conventional and experimental combustors over a range of combustor-inlet conditions are presented. Combustor design techniques for reducing pollutant emissions are discussed. Improved fuel atomization resulting from the use of air-assist fuel nozzles has brought about significant reductions in hydrocarbon and carbon monoxide emissions at idle. Diffuser tests have shown that the combustor-inlet airflow profile can be controlled through the use of diffuser-wall bleed and that it may thus be possible to reduce emissions by controlling combustor airflow distribution. Emissions of nitric oxide from a shortlength annular swirl-can combustor were significantly lower than those from a conventional combustor operating at similar conditions.
Author

N72-18010*# Bell Aerospace Co., Buffalo, N.Y.
DESIGN AND EVALUATION OF ACTIVE COOLING SYSTEMS FOR MACH 6 CRUISE VEHICLE WINGS
W. A. McConarty and F. M. Anthony Washington NASA Dec. 1971 270 p refs
(Contract NAS1-7468)
(NASA-CR-1916; Rept-7305-901001) Avail: NTIS CSCL 01B

Active cooling systems, which included transpiration, film, and convective cooling concepts, are examined. Coolants included hydrogen, helium, air, and water. Heat shields, radiation barriers, and thermal insulation are considered to reduce heat flow to the cooling systems. Wing sweep angles are varied from 0 deg to 75 deg and wing leading edge radii of 0.05 inch and 2.0 inches are examined. Structural temperatures are varied to allow comparison of aluminum alloy, titanium alloy, and superalloy structural materials. Cooled wing concepts are compared among themselves, and with the uncooled concept on the basis of structural weight, cooling system weight, and coolant weight.
Author

N72-18011*# Bell Aerospace Co., Buffalo, N.Y.
DESIGN OF A CONVECTIVE COOLING SYSTEM FOR A MACH 6 HYPERSONIC TRANSPORT AIRFRAME
R. G. Helenbrook and F. M. Anthony Washington NASA Dec. 1971 131 p refs
(Contract NAS1-7468)
(NASA-CR-1918; Rept-7305-903001) Avail: NTIS CSCL 01B

Results of analytical and design studies are presented for a water-glycol convective cooling system for the airframe structure of a hypersonic transport. System configurations and weights are compared. The influences of system pressure drop and flow control schedules on system weight are defined.
Author

N72-18012*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
INVESTIGATION OF AN AUTOMATIC SPIN PREVENTION

SYSTEM FOR FIGHTER AIRPLANES
William P. Gilbert and Charles E. Libbey Washington Mar. 1972 49 p refs
(NASA-TN-D-6670; L-8112) Avail: NTIS CSCL 01B

An investigation was conducted to evaluate the effectiveness of an automatic spin-prevention system for current fighter airplanes as a first step in determining the feasibility of such a system. The concept makes use of the components of the conventional flight-control system with the addition of control logic to monitor angle of attack, yaw rate, and normal acceleration. Analytical techniques were used to study the system concept applied to three representative fighter configurations, and model flight tests were employed to evaluate a prototype system on a representative fighter configuration. Emphasis was placed on the development of the control logic required. A discussion of possible implementations of the system concept is presented. Results of the investigation indicated that a relatively simple system (with full control authority) was effective in preventing the developed spins of the fighter configurations considered and that the system design is dependent on the stall and spin characteristics of the particular airplane. Author

N72-18013*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
LONGITUDINAL STABILITY AND CONTROL DERIVATIVES OF A JET FIGHTER AIRPLANE EXTRACTED FROM FLIGHT TEST DATA BY UTILIZING MAXIMUM LIKELIHOOD ESTIMATION
George G. Steinmetz, Russell V. Parrish, and Roland L. Bowles Washington Mar. 1972 44 p refs
(NASA-TN-D-6532; L-7882) Avail: NTIS CSCL 01B

A method of parameter extraction for stability and control derivatives of aircraft from flight test data, implementing maximum likelihood estimation, was developed and successfully applied to actual longitudinal flight test data from a modern sophisticated jet fighter. The results of this application establish the merits of the estimation technique and its computer implementation (allowing full analyst interaction with the program) as well as provide data for the validation of a portion of the differential maneuvering simulator (DMS). The results are presented for all flight test runs in tabular form and as time history comparisons between the estimated states and the actual flight test data. Comparisons between extracted and manufacturer's values for five major derivatives are presented and reveal good agreement for these principal derivatives with one exception. This particular derivative is extensively investigated by utilizing the interactive capabilities of the computer program. The results of this investigation verify the numbers extracted by maximum likelihood estimation. Author

N72-18014*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MIXER NOZZLE-EXTERNALLY BLOWN FLAP NOISE TESTS
Jack H. Goodykoontz, Robert G. Dorsch, and Donald E. Groesbeck Feb. 1972 19 p
(NASA-TM-X-68021; E-6827) Avail: NTIS CSCL 01B

A summary is given of the noise suppression tests conducted for the STOL aircraft. The tests were made using a large scale mixer nozzle and externally blown flap model. Data were obtained over a range of nozzle exhaust velocities (172 to 284 m/sec) and flap angles. Comparisons were made between the results of the mixer nozzle and those obtained with a standard single convergent nozzle. The resulting conclusions show that a reduction in noise level did occur using the mixer nozzle system. Author

N72-18015# Air Canada, Montreal (Quebec).
MAINTENANCE QUALITY AUDIT PROGRAM
R. J. Thatcher 1971 12 p Presented at 7th Ann. FAA Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971
Avail: NTIS

A quality control program for application to the maintenance of commercial aircraft is presented. The maintenance organization involved in the operation is discussed. The two major areas of concern are: (1) the decisions and programs with respect to what maintenance will be carried out when and (2) the quality and consistency of the actual scheduled and unscheduled work. The application of the system to aircraft operated by Air Canada airlines is emphasized. Author

N72-18016# Atlantic Aviation Corp., Wilmington, Del. Aircraft Maintenance Service.
THE FIXED BASE OPERATOR'S INSPECTION RESPONSIBILITIES CONFORMANCE WITH CUSTOMERS INSPECTION PROGRAM
John G. Hite 17 Nov. 1971 9 p Presented at the 7th Ann. FAA Intern. Aviation Maintenance Symp., 7-9 Dec. 1971
Avail: NTIS

The responsibilities and duties of fixed base operators, taken to mean aircraft maintenance shop operators in business to support the aviation public, are considered with regard to aircraft inspection. The FAA regulations and options afforded to the operator are discussed. K.P.D.

N72-18017# Federal Aviation Administration, Washington, D.C. Maintenance Div.
ACHIEVING GENERAL AVIATION SAFETY GOALS THROUGH AN AIRWORTHINESS SYSTEM
Sam J. Corso 1971 16 p Presented at 7th Ann. Maintenance Symp., Oklahoma City, Dec. 1971
Avail: NTIS

A number of safety goals to promote airworthiness systems for flight safety are presented. They encompass inspection rules for the design and manufacture of aeronautical products, overhaul and repair manuals for aircraft maintenance, operating procedures for use of manpower and manpower standards, regulations for ground services, and maintenance research. G.G.

N72-18018# United Air Lines, Inc., Chicago, Ill.
THE RELATIONSHIP BETWEEN MAINTENANCE AND OPERATING SAFETY IN AIR TRANSPORTATION
T. D. Matteson 1971 14 p refs Presented at 7th Ann. FAA Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971
Avail: NTIS

The effect of design on safety and reliability is examined. The effectiveness of air transport maintenance and methods for its improvement are discussed. K.P.D.

N72-18019# Douglas Aircraft Co., Inc., Santa Monica, Calif. Structural Mechanics Subdiv.
DEVELOPING THE DC-10 STRUCTURAL INSPECTION PROGRAM
M. E. Stone and H. F. Heap (United Air Lines) 1971 59 p refs Presented at 7th Ann. FAA Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971
Avail: NTIS

The development of a structural inspection program to extend the service life of DC-10 aircraft is discussed. The three steps required to achieve a safe and economical structure with a service life of twenty years are presented. The factors which affect the variability of service life are described. The basis for the structural inspection program depends upon the effects of fatigue, crack propagation, residual strength, corrosion, and preload. The major differences between the DC-10 inspection program and more conventional programs are identified. Author

N72-18020# General Electric Co., Cincinnati, Ohio. Commercial Engine Div.
CF6-6 ENGINE MAINTENANCE PLANNING AND EXPERIENCE
S. H. Davison 1971 54 p Presented at 7th Ann. Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971; sponsored by FAA

Avail: NTIS

The proceedings of the International Aviation Maintenance Symposium concerning engine maintenance planning and experience on the CF6-6 jet engine are presented. The important elements used in the development of the maintenance plan are presented. The significance of the relationship of each element to the development of the engine maintenance management program is examined. The process to be followed for correct diagnosis of problem areas and response to the maintenance problem is described. P.N.F.

N72-18021# National Transportation Safety Board, Washington, D.C.

MAINTENANCE, A DIRECT FACTOR IN AVIATION SAFETY

James T. Childs 1971 13 p Presented at 7th Ann. FAA Intern. Aviation Maintenance Symp., Oklahoma City, 7-9 Dec. 1971

Avail: NTIS

The effects of aircraft maintenance practices as an aircraft accident causal factor are discussed. A statistical analysis is presented to show the significance of improper maintenance, servicing, or inspection as an influence on the safe operation of aircraft. It is concluded that a major step toward better aircraft safety can be accomplished with the elimination of maintenance and servicing faults supported by meticulous quality inspection. Author

N72-18022# Federal Aviation Administration, Washington, D.C.

THE FAA'S MAINTENANCE ANALYSIS CENTER

Dec. 1971 6 p

Avail: NTIS

The operation of the Federal Aviation Administration Maintenance Analysis Center is discussed. The objective of the center is to improve aviation safety through service difficulty analysis and the interchange of service difficulty information. The reliability systems, microfilm data bank, technical library and communications procedures are described. The four major computer programs currently in operation by the center are defined. Author

N72-18023# Douglas Aircraft Co., Inc., Santa Monica, Calif. Maintenance Data Analysis.

MAINTAINABILITY AND MAINTENANCE MEASUREMENT

R. V MacGregor 1971 18 p Presented at the Ann. FAA Intern. Aviation Maintenance Symp., Oklahoma City, 7 Dec. 1971

Avail: NTIS

The concept of quantitatively defining and measuring maintainability loss or achievement in the environment of the designer and manufacturer is considered. A most important difference between maintainability and maintenance measurements is the distinction between cost and value as a characteristics of design. The ability to hypothesize coefficients of lift and drag, and to subsequently measure them in wind tunnel tests, produces relative but measurable values. G.G.

N72-18024*# Lockheed-California Co., Burbank.

CHARACTERISTICS OF HINGELESS ROTORS WITH HUB MOMENT FEEDBACK CONTROLS INCLUDING EXPERIMENTAL ROTOR FREQUENCY RESPONSE, VOLUME 1 Final Report

W. A. Kuczynski and G. J. Sissingh Jan. 1972 143 p refs

(Contract NAS2-5419)

(NASA-CR-114427; LR-25048-Vol-1) Avail: NTIS CSCL 01B

Wind tunnel tests to determine the dynamic characteristics of hingeless rotors with hub moment feedback controls and to acquire experimental hingeless rotor transfer functions are discussed. Rotor transfer functions were calculated from data acquired during open loop frequency response tests. The transfer functions are linear and present the rotor longitudinal and lateral frequency responses to collective pitch, longitudinal cyclic pitch, and lateral cyclic pitch. The theoretical analysis was based on the rigid blade flapping model coupled with appropriate control system and cyclic pitch actuator equations of motion. P.N.F.

N72-18025*# Lockheed-California Co., Burbank.

CHARACTERISTICS OF HINGELESS ROTORS WITH HUB MOMENT FEEDBACK CONTROLS INCLUDING EXPERIMENTAL ROTOR FREQUENCY RESPONSE, VOLUME 2 Final Report

W. A. Kuczynski and G. J. Sissingh Jan. 1972 172 p

(Contract NAS2-5419)

(NASA-CR-114428; LR-25048-Vol-2) Avail: NTIS CSCL 01B

The test obtained from wind tunnel tests of a rigid rotor with hub feedback controls are presented. Four types of tests were conducted and the data from each are presented in separate appendices. The data are presented in the form of tables and charts. Author

N72-18026# Sydney Univ. (Australia).

THE CONTROL OF WING TIP VORTICES Dept. of Aeronautical Engineering.

E. D. Poppleton Aug. 1971 10 p refs

(ATN-7102) Avail: NTIS

A device is proposed for the control of the velocity distribution in the core of a trailing vortex. Preliminary calculations show that the required plan-form shape does not differ radically from that of a conventional wing, and that there is a considerable reduction in vortex drag. Author

N72-18027# Colorado Univ., Boulder. Dept. of Electrical Engineering.

FLIGHT SAFETY ASPECTS OF RADAR TECHNIQUES IN BIRD/AIRCRAFT COLLISION AVOIDANCE Final Report, 1 Oct. 1967 - 30 Sep. 1971

Warren L. Flock Sep. 1971 13 p refs

(Grant AF-AFOSR-1377-68; AF Proj. 9777)

(AD-732945; AFOSR-71-2917TR) Avail: NTIS CSCL 01/2

Federal Aviation Administration and Air Force surveillance radars are capable of monitoring bird movements efficiently and can be used to minimize the hazard of collisions between birds and aircraft if those responsible for the operation of these systems take a sufficient interest in this application. This statement is supported by successive-time-exposure photographic recordings of bird echoes seen by the North Platte and Denver radars. In addition, visits have been made to numerous FAA air route surveillance centers in the lower forty-eight states and DEW and AC and W radar sites in Alaska. Simultaneous monitoring of radar screens at three FAA centers on one occasion provided information about bird movements in the area from Ohio on the east to Arizona on the West. Air Force radars in Alaska have provided interesting new information on bird migration between Alaska and Siberia and along the coastline of Alaska. Such use of existing radar systems on a partially multipurpose basis justifies further their expense of operation. The research conducted with the support of the AFOSR has led to new programs of research, at the University of Colorado, involving the bird hazard in the immediate vicinity of airports and the identification of birds by radar. Author (GRA)

N72-18028# Army Materials and Mechanics Research Center, Watertown, Mass. Structural Mechanics Div.

RESPONSE OF ROTOR BLADES TO RANDOM INPUTS. PART 1: BENDING MODES

Chatta Lakshmikantham and Chintakindi V. JogaRao Jul. 1971 18 p refs

(DA Proj. 1T0-61102-B-33-A)

(AD-732395; AMMRC-TR-71-20-Pt-1) Avail: NTIS CSCL 01/3

The bending response of flexible rotating blades in an airflow is investigated when the input velocities are random functions of time. The spectral density and the mean square of the transverse displacement of the blade is computed, based on the spectral density of the input function. Results for both hinged and hingeless cases of root-end fixity are obtained and compared. Author (GRA)

N72-18029# National Transportation Safety Board, Washington, D.C.

AIRCRAFT ACCIDENT REPORT: ROCKY MOUNTAIN AIRWAYS, INCORPORATED, AERO COMMANDER 680V, N6359U, ASPEN, COLORADO, 22 JANUARY 1970

29 Dec. 1971 31 p refs
(NTSR-AAR-72-1) Avail: NTIS

Rocky Mountain Airways, Inc., Flight 10, Aero Commander 680V, N6395U, crashed at approximately 0806 mountain standard time, January 22, 1970, near Aspen, Colorado. The aircraft struck obstructing terrain after the pilot discontinued an approach to land because of an ice accumulation on the windshield of the aircraft. The probable cause of this accident was the pilot's use of other than the recommended procedures for a go-around following the discontinuance of a landing approach. The landing approach was discontinued, and a go-around attempted because the aircraft was too high to attempt a straight-in approach. The ice accumulation on the windshield obscured the obstructing terrain. Author

N72-18030# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept. (SI)

CARRIER AIRCRAFT OPERATIONAL COMPATIBILITY SYSTEM (CAOCS - MOD 2) COMPUTER PROGRAM Program Development and Operation Report, May 1970 - Mar. 1971

Eugene P. Lorge and Paul M. Saia 20 Oct. 1971 405 p refs
(AD-732755; NAEC-ENG-7695) Avail: NTIS CSCL 01/1

The report describes the development and operation of the Carrier Aircraft Operational Compatibility System, Model 2 (CAOCS - MOD 2). As with CAOCS - MOD 1, this computerized system allows a numerical evaluation of naval carrier aircraft in the aircraft carrier environment. The comprehensive evaluation which results is a combination of parameter and criteria definition coupled with a definitive rating system, both of which have been computerized and are evidenced by a hard copy print-out. Mod 2 incorporates modifications to the earlier program, principally involving standardization, which resulted in reductions in computer operating times, storage and core requirements and overall program volume. Contained within this report are descriptions concerning historical development, program philosophies, rating techniques employed and computer program development, operation and maintenance. Author (GRA)

N72-18031# RAND Corp., Santa Monica, Calif.

A MODEL FOR EVALUATING V/STOL VERSUS CTOL COMBAT AIRCRAFT SYSTEMS

Seymour Horowitz (FAA) and Robert Shishko Mar. 1971 31 p refs
(AD-732681; P-4587) Avail: NTIS CSCL 01/3

The paper describes a cost-effectiveness study of the use of vertical or short takeoff and landing (V/STOL) aircraft for combat missions. A comparison is made with conventional (CTOL) aircraft as tactical fighters in a future NATO environment. A model yielding the probability of completing n successive missions is used as a measure of combat effectiveness. A cost model was constructed to reflect the resource impact of the same variables or alternatives that affect the measure of effectiveness. Author (GRA)

N72-18032# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.

A REVISED CRITICAL STATE IDENTIFICATION SCHEME FOR THE WAVE-OFF DECISION DEVICE

Mark E. Reigle 27 Oct. 1971 34 p refs
(AD-732760; NADC-AM-7121) Avail: NTIS CSCL 01/2

A revised critical flight state identification scheme has been developed for the Wave-Off Decision Device. The new program, referred to as Terminal State Predictor, predicts accurately the ramp altitude clearance of an aircraft approaching a carrier and identifies a critical wave-off state. Author (GRA)

N72-18033# Air Force Dept., Washington, D.C.

THE DEVELOPMENT AND TEST OF THREE FLIGHT TEST B-1 AIRCRAFT WAS PREPARED ON 25 MARCH, 1971, B-1 WEAPONS SYSTEM

3 Nov. 1971 33 p Supercedes PB-201711-D
(PB-201711-F; AF-ES-71-2F) Avail: NTIS CSCL 01C

The major environmental impacts are air pollution and noise. These will have less of an adverse environmental impact than current military aircraft. Author (GRA)

N72-18034# Air Force Dept., Washington, D.C.

F-15 AIRCRAFT Final Environmental Statement

3 Nov. 1971 34 p refs
(PB-201710-F; AF-ES-71-3F) Avail: NTIS CSCL 01C

The major environmental impacts are air pollution and noise. These are not considered as adverse environmental effects, as compared to present systems and the achievements in reducing the current effects on air and sound. Author (GRA)

N72-18035# Bolt, Beranek, and Newman, Inc., Canoga Park, Calif.

AVIATION NOISE EVALUATIONS AND PROJECTIONS: SAN FRANCISCO BAY AREA

Aug. 1971 151 p refs Sponsored by HUD
(PB-204035) Avail: NTIS CSCL 20A

Effects of aviation noise upon the region are presented. Certain assumptions as to future runway utilization, aircraft types, and airport use were necessary. The NEF noise environment analysis procedure represents the best knowledge of aviation-generated noise and its impact upon human activities. GRA

N72-18036# Aberdeen Proving Ground, Md. Human Engineering Labs.

SEARCH AND RESCUE CREW COMPARTMENT MOCK-UP PROGRAM

John A. Barnes Sep. 1971 39 p refs
(NR Proj. 213-072B)
(AD-733375; APG-TM-16-71; JANAIR-710601) Avail: NTIS CSCL 01/3

A new cockpit system designed for a Search and Rescue Helicopter to satisfy the needs of the Army, Navy, Air Force and Coast Guard and to comply with existing Military Specifications and Standards is described in detail and accompanied by scale drawings. Author (GRA)

N72-18037# ARO, Inc., Arnold Air Force Station, Tenn.

CALCULATION OF FORCES ON AIRCRAFT STORES LOCATED IN DISTURBED FLOW FIELDS FOR APPLICATION IN STORE SEPARATION PREDICTION Final Report, 1 Apr. 1970 - 30 Jun. 1971

W. N. MacDermott and P. W. Johnson AEDC Nov. 1971 68 p refs
(Contract F40600-72-C-0003)
(AD-733325; AEDC-TR-71-186; ARO-PWT-TR-71-150) Avail: NTIS CSCL 19/2

The aerodynamic characteristics of an M-117 bomb in steady, incompressible, potential flow are computed by representing the bomb planform with a discrete network of vortex singularities. Distribution of velocity and pressure coefficients over the bomb, as well as total force and moment coefficients, are calculated as functions of pitch attitude, the surrounding flow field, and various assumed vortex-lattice modelings. Both spatially uniform and nonuniform flow fields are investigated; the nonuniformities were created by the presence of a parent aircraft. For a properly modeled bomb immersed in a uniform flow, the lift and pitching moment coefficients summed over the entire configuration are found to be within 10 percent of wind tunnel measurements. When the bomb is surrounded by the disturbance flow field produced by an F-4C aircraft, the incremental effects on lift and pitching moment are very similar for theory and experiment. Author (GRA)

N72-18038# Dynamic Science, Phoenix, Ariz. AvSER Facility.
CRASH SURVIVAL DESIGN GUIDE
J. W. Turnbow, D. F. Carroll, J. L. Haley, Jr., W. H. Reed, S. H. Robertson, S. H. Weinberg, H. G. C. Henneberger, S. P. Desjardins, A. D. Harper, R. L. Cook et al Ft. Eustis, Va. Army Air Mobility Res. and Develop. Lab. Oct. 1971 444 p refs Revised Supersedes AD-695648, dated Aug. 1969
(Contract DAAJ02-69-C-0030; DA Proj. 1F1-62203-A-529)
(AD-733358; AVSER-1500-71-6; USAAMRDL-TR-71-22) Avail: NTIS HC $6.00/MF $0.95 CSCL 01/3

The guide presents design techniques and criteria which are presently available in flight areas: aircraft crash kinematic and survival envelopes; airframe crashworthiness design criteria; aircraft seat design criteria (crew and troop/passenger); restraint system design criteria (crew, troop/passenger and cargo); occupant environment design criteria; emergency escape provisions; and postcrash fire design criteria. Author (GRA)

N72-18039# Army Cold Regions Research and Engineering Lab., Hanover, N.H.
SNOW SURFACE EROSION FROM A PERIPHERAL JET CUSHION ACV
Gunars Abele and William H. Parrott Oct. 1971 22 p
(ARPA Order 1615)
(AD-733319; CRREL-SR-163) Avail: NTIS CSCL 01/3

Travel with an SK-5 ACV over soft snow results in surface deformation/erosion of a few inches, caused primarily by rear skirt drag; on windswept snow only scratches can be seen. During hovering on soft snow, deformation below the cushion chamber usually does not exceed a few inches. The action of the air flow, which has an escape velocity of 70 to 120 ft/sec, produces a 1-ft ditch below the peripheral skirt in less than a minute; thereafter the extent of erosion does not increase appreciably during continued hovering. A partial seal between the inner face of the skirt, above the fingers, and the snow surface may exist, arresting further settling of the vehicle. Relatively cohesive layers of snow such as wind slabs and crusts are not eroded. A level snow cover, regardless of how deep or soft, does not appear to be capable of immobilizing an ACV of this or larger size. Author (GRA)

N72-18040# McDonnell Aircraft Corp., St. Louis, Mo.
SURVIVABLE FLIGHT CONTROL SYSTEM. STUDIES, ANALYSES AND APPROACH
David S. Hooker, Robert L. Kisslinger, George R. Smith, and M. Sheppard Smyth May 1971 383 p refs
(Contract F33615-69-C-1827; AF Proj. 680J)
(AD-733582; AFFDL-TR-71-20; IR-1) Avail: NTIS CSCL 01/3

The Survivable Flight Control System (SFCS) Program is an advanced development program of which the principal objective is the development and flight test demonstration of an SFCS utilizing Fly-By-Wire and Integrated Actuator Package techniques. The studies and analyses conducted to date have sufficiently defined the system requirements to provide a definition of an approach to the implementation of the SFCS. The results of these studies and the definition of the approach are presented. Author (GRA)

N72-18041# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
DIAGNOSTIC AND INSPECTION EQUIPMENT (AIRCRAFT) Final Report
1 Nov. 1971 18 p refs
(AMCR Proj. 310-6)
(AD-733283; MTP-7-3-059) Avail: NTIS CSCL 01/3

The report describes a system for evaluation of aircraft diagnostic and inspection equipment performance characteristics. Provides procedures for test preparation, initial inspection, electrical power requirements, compatibility with related equipment, operational performance, electromagnetic interference, durability, maintenance evaluation, maintainability, reliability, safety, human factors, and personnel training requirements. Author (GRA)

N72-18042# Army Foreign Science and Technology Center, Charlottesville, Va.
AIR-CUSHION VESSELS
G. P. Zlobin and Yu. A. Simonov 28 Oct. 1971 249 p refs Transl. into ENGLISH of the publ. "Sudana Vozdushnoy Podushke" Leningrad, Sudostr. Publishing House, 1971 p 1-212
(AD-733499; FSTC-HT-23-1586-71) Avail: NTIS CSCL 13/10

Practical information based on foreign press reports on designing and operation of air-cushion vessels is presented. Principal dimension and operating characteristics, hull strength, stability and maneuverability are discussed. A comparative cost-accounting estimate is given for ferry and transport applications of ACV for lines from 15 to 4000 miles long. ACV operation in different sea states is compared by variant of the air-cushion principle involved in ships built by British, American, *Japanese, French, and other manufacturing companies.* Engineering problems in designing long distance transport ACV are treated near the end of the book. Author (GRA)

N72-18043# *Transportation Systems Center, Cambridge, Mass.*
SIMULATION MODEL FOR THE PIPER PA-30 LIGHT MANEUVERABLE AIRCRAFT IN THE FINAL APPROACH
Joseph F. Koziol, Jr. Jul. 1971 30 p refs Sponsored by FAA
(AD-733757; TSC-FAA-71-11) Avail: NTIS CSCL 01/2

The report describes the Piper PA-30 Twin Comanche aircraft and a representative autopilot during the final approach configuration for simulation purposes. The aircraft is modeled by *linearized six-degree-of-freedom perturbation equations refer-*enced to the aircraft stability axis. Other equations are presented which derive the body axis rates, velocities and accelerations, *and ground referenced velocities (translation equations).* The autopilot is a representative system for automatic ILS approaches from initial localizer track down to decision height. The glideslope system is engaged by approaching the glidepath at constant altitude (usually in the altitude hold mode) on the localizer beam. The pilot must take over manually at the decision height since light aircraft are not normally equipped with automatic flare capability. The aircraft autopilot model described herein has been used extensively in simulation studies at TSC and exhibits the expected behavior. Author (GRA)

N72-18044# Goodyear Aerospace Corp., Akron, Ohio.
INVESTIGATION OF STABILITY CHARACTERISTICS OF TETHERED BALLOON SYSTEMS
George R. Doyle, Jr. and Jerome J. Vorachek 30 Jul. 1971 231 p refs
(Contract F19628-71-C-0091; AF Proj. 7659)
(AD-731570; GER-15325; AFCRL-71-0406; SR-2) Avail: NTIS CSCL 01/3

An analytical investigation of the dynamic behavior of tethered balloons is in progress. The report, the second of three scientific reports, covers a study of stability characteristics of tethered balloon systems. Balloon systems which are investigated use the British BJ Barrage Balloon, the Vee Balloon and a Goodyear Aerospace Model No. 1649 Single-Hull Balloon. The major tether construction is Columbian Rope Company's NOLARO utilizing prestretched polyester filaments. Three design altitudes, 5,000, 10,000 and 20,000 feet, are considered. The model for the tethered balloon system consists of the streamlined balloon and a tether made up of three discrete links. Computer programs for the IBM 360 digital computer are presented to determine the characteristic equations of the systems, and obtain the roots which represent the frequency and damping qualities. Author (GRA)

N72-18045# *Air Force Systems Command, Wright-Patterson AFB, Ohio.*

FRACTURE CONTROL PROCEDURES FOR AIRCRAFT STRUCTURAL INTEGRITY

Howard A. Wood Jul. 1971 90 p refs Presented at the Intern. Comm. on Aeron. Fatigue, Miami Beach, Fla., 13-14 May 1971

(AF Proj. 1467)

(AD-731565; AFFDL-TR-71-89) Avail: NTIS CSCL 01/3

The report reviews the application of applied fracture mechanics in the design, analysis and qualification of aircraft structural systems. Recent service experiences are cited. Current trends in high strength materials application are reviewed with particular emphasis on the manner in which fracture toughness and structural efficiency may affect the material selection process. General fracture control procedures are reviewed in depth with specific reference to the impact of inspectability, structural arrangement and material on proposed analysis requirements for safe crack growth. The relative impact on allowable design stress is indicated by example. Design criteria, material and analysis requirements for implementation of fracture control procedures are reviewed together with limitation in current available data techniques. A summary of items which require further study and attention is presented. Author (GRA)

N72-18046# Air Force Academy, Colo.

ADVANCED AIRCRAFT PROPULSION/ENGAGEMENT STUDY, VOLUME 2

Sep. 1971 75 p refs

(AD-731578; USAFA-RR-71-7-Vol-2) Avail: NTIS CSCL 01/3

The report considers some of the aspects of one-on-one engagements between aircraft. In addition to some general observations and comments, it presents results of the application of differential games techniques. Additional investigations concern the geometry of the intercept problems and minimum time turns. Author (GRA)

N72-18047# Naval Air Development Center, Johnsville, Pa. Aero Mechanics Dept.

AN EVALUATION OF SEARCH AND RESCUE MISSION CHARACTERISTICS Final Report

Thomas J. Brennan 10 Nov. 1971 135 p refs

(AD-733987; NADC-AM-7136) Avail: NTIS CSCL 01/3

The report provides an overview of the general requirements for an airborne rescue system to fulfill a military SAR (Search and Rescue) mission. Projected mission and airframe/propulsion system requirements are presented to provide a baseline for initial development analyses. A standard methodology for the conduct of detailed performance evaluation and overall mission analyses are proposed to define critical areas in SAR aircraft designs. An aircraft/propulsion system is designed to illustrate the applications. Author (GRA)

03 AUXILIARY SYSTEMS

Includes fuel cells, energy conversion cells, and solar cells; auxiliary gas turbines, hydraulic, pneumatic and electrical systems; actuators, and inverters. For related information see also: 09 Electronic Equipment; 22 Nuclear Engineering; and 28 Propulsion Systems.

N72-18048*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

MATHEMATICAL MODEL OF WATER TRANSPORT IN BACON AND ALKALINE MATRIX-TYPE HYDROGEN-OXYGEN FUEL CELLS

Paul R. Prokopius and Robert W. Easter Washington Mar. 1972 48 p refs

(NASA-TN-D-6609; E-6118) Avail: NTIS CSCL 10C

Based on general mass continuity and diffusive transport equations, a mathematical model was developed that simulates the transport of water in Bacon and alkaline-matrix fuel cells. The derived model was validated by using it to analytically reproduce various Bacon and matrix-cell experimental water transport transients. Author

N72-18049*# Radio Corp. of America, Princeton, N.J. Government and Commercial Systems.

STUDY TO DETERMINE AND IMPROVE DESIGN FOR LITHIUM-DOPED SOLAR CELLS Final Report, 24 Jun. 1969 - 24 Sep. 1971

G. Brucker, T. Faith, and A. Holmes-Siedle 3 Dec. 1971 147 p refs Prepared for JPL

(Contract JPL-952555)

(NASA-CR-125664) Avail: NTIS CSCL 10C

Solar cell experiments show that a single lithium density parameter, the lithium density gradient, calculated from nondestructive capacitance measurements, provides the basis for accurate predictions of lithium cell behavior in a 1-MeV electron environment for fluences ranging between 3 X 10 to the 13th power e/sq cm and 3 X 10 to the 15th power/e sq cm. The oxygen-rich (quartz crucible) lithium cell with phosphorous starting dopant and lithium gradient between approximately 5 X 10 to the 18th power and 1.5 x 10 to the 19th power/cm to the 4th power was found superior in performance to the commercial 10 ohm-cm n/p control cells. Post-recovery stability of oxygen-rich cells was satisfactory. An average post-recovery current drop of approximately 1 mA was observed for 70 crucible cells after 1 year-equivalent storage time at 80 C. In contrast the oxygen-poor (float zone and Lopex) lithium cells displayed spotty initial performance and stability problems at room temperature. Author

N72-18050*# *Tyco Labs., Inc., Waltham, Mass.*

DEVELOPMENT OF UNIFORM AND PREDICTABLE BATTERY MATERIALS FOR NICKEL-CADMIUM AEROSPACE CELLS Semiannual Report, 8 Nov. 1970 - 8 May 1971

8 May 1971 40 p refs

(Contract NAS5-11561)

(NASA-CR-125660) Avail: NTIS CSCL 10C

Battery materials and manufacturing methods were analyzed with the aim of developing uniform and predictable battery plates for nickel cadmium aerospace cells. A study is presented for the high temperature electrochemical impregnation process for the preparation of nickel cadmium battery plates. This comparative study is set up as a factorially designed experiment to examine both manufacturing and operational variables and any interaction that might exist between them. The manufacturing variables in the factorial design include plaque preparative method, palque porosity and thickness, impregnation method, and loading. The operational variables are type of duty cycle, charge and discharge rate, extent of overcharge, and depth of discharge. Author

N72-18051*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

BLEED CYCLE PROPELLANT PUMPING IN A GAS-CORE NUCLEAR ROCKET ENGINE SYSTEM

Albert F. Kascak and Annie J. Easley Washington Mar. 1972 76 p refs

(NASA-TM-X-2517; E-6639) Avail: NTIS CSCL 21F

The performance of ideal and real staged primary propellant pumps and bleed-powered turbines was calculated for gas-core nuclear rocket engines over a range of operating pressures from 500 to 5000 atm. This study showed that for a required engine operating pressure of 1000 atm the pump work was about 0.8 hp/(lb/sec), the specific impulse penalty resulting from the turbine propellant bleed flow as about 10 percent; and the heat required to preheat the propellant was about 7.8 MN/(lb/sec). For a specific impulse above 2400 sec, there is an excess of energy available in the moderator due to the gamma and neutron heating that occurs there. Possible alternative pumping cycles are the Rankine or Brayton cycles. Author

N72-18052*# AiResearch Mfg. Co., Los Angeles, Calif.
BRAYTON HEAT EXCHANGE UNIT DEVELOPMENT PROGRAM Final Design Report
C. J. Morse, C. E. Richard, and J. D. Duncan 29 May 1971 182 p refs
(Contract NAS3-10607)
(NASA-CR-120816; AiResearch-71-7450) Avail: NTIS CSCL 10A

A Brayton Heat Exchanger Unit (BHXU), consisting of a recuperator, a heat sink heat exchanger and a gas ducting system, was designed, fabricated, and tested. The design was formulated to provide a high performance unit suitable for use in a long-life Brayton-cycle powerplant. A parametric analysis and design study was performed to establish the optimum component configurations to achieve low weight and size and high reliability, while meeting the requirements of high effectiveness and low pressure drop. Layout studies and detailed mechanical and structural design were performed to obtain a flight-type packaging arrangement. Evaluation testing was conducted from which it is estimated that near-design performance can be expected with the use of He-Xe as the working fluid. Author

N72-18053# Rasor (Ned S.), Dayton, Ohio.
PRACTICAL ASPECTS OF FUNDAMENTAL RESEARCH IN THERMIONIC CONVERSION Summary Technical Report, 1 Sep. 1970 - 31 Oct. 1971
Ned S. Rasor and E. J. Britt 30 Nov. 1971 49 p refs
(Contract N00014-70-C-0252)
(AD-733081; NSR-1-3) Avail: NTIS CSCL 10/2

The report summarizes the results of the past year in a continuing effort to utilize basic converter research for practical improvement of engineering designs. Experimental results are presented which were obtained with an argon discharge used as an experimental analog for a cesium vapor system. Attempts to suppress the power lost in the arc voltage drop are described. An auxilliary discharge triode was investigated in the argon system. A more extensive study of arc drop suppression by pulse enhancement was carried out for both argon and cesium diodes. A theoretical correlation is presented which allows the emitter temperature in a converter to be determined from the J-V characteristic. An analytical description of the adsorption phenomenology for cesium and oxygen on tungsten is presented. The features of the analysis are generally applicable to adsorbate-substrate systems with both monatomic and diatomic molecules. Author (GRA)

N72-18054# Army Electronics Command, Fort Monmouth, N.J.
CADMIUM-AIR CELL STUDIES
Otto C. Wagner Jul. 1971 19 p refs
(DA Proj. 1T6-62705-A-053)
(AD-733290; ECOM-3451) Avail: NTIS CSCL 10/3

A cadmium-air cell was developed that will deliver at least 500 deep discharge cycles without any significant loss in electrical capacity and without any decrease in closed circuit potential. However, after one year's storage (at room temperature), the cell becomes cathode limiting with a resulting 15% loss in electrical capacity and a large drop in cell potential. Cadmium poisoning of the air-cathode can be avoided by constructing the unit cells with washed dry charged cadmium anodes. A paper design of a 24 volt, 25 ampere-hour cadmium-air battery indicates the following characteristics: 42 watt-hours/pound; 2.35 watt-hours/cu in; price-about $500.00; $0.0017 per watt-hours per cycle (assuming 500 cycles). Author (GRA)

N72-18055# Pratt and Whitney Aircraft, East Hartford, Conn.
CIRCULATING ELECTROLYTE FUEL CELL POWERPLANT Final Report, 1 Feb. - 30 Nov. 1970
William R. Peak and Thomas G. Schiller Sep. 1971 57 p
(Contract DAAB07-70-C-0125)
(AD-733420; PWA-4073; ECOM-0125-F) Avail: NTIS CSCL 10/2

The technical feasibility of a hydrogen-air circulating alkaline electrolyte fuel cell system incorporating electrolyte regeneration capability has been demonstrated. The fuel cell design features four channels on the air side through which the potassium hydroxide electrolyte flows. The feasibility of this cell design was demonstrated by a 650 hour single cell test. The electrochemical regenerator cells convert carbonates in the liquid electrolyte into potassium hydroxide and carbon dioxide and rejects the carbon dioxide. Single cell regenerator rig tests have demonstrated 200 hours operating capability with adequate carbon dioxide rejection rates. A breadboard 425 watt fuel cell powerplant was constructed consisting of a cell product water removal in a packaged configuration. The cell stack included 22 fuel cells and 2 regenerator cells. Author (GRA)

N72-18056# Eagle-Picher Industries, Inc., Joplin, Mo.
BATTERY BB-674( )/U NICKLE ZINC SECONDARY Final Report, Apr. 1970 - May 1971
Edward P. Broglio Nov. 1971 46 p
(Contract DAAB07-70-C-0171; DA Proj. 1T6-62705-A-053)
(AD-733422; ECOM-0171-F) Avail: NTIS CSCL 10/3

The design, development and test of the BB-674( )/U battery is described in detail. The BB-674( )/U is a 4 cell nickel-zinc secondary battery. It is rated at 6.5 volts and 35 ampere-hours capacity. The design has 40 A-H of positive capacity in standard sintered nickel plates and teflonated ZnO negative plates. The zinc plates have almost 4 times the required coulombic capacity and are equal in area to the positive plates but are edge densified to retard shape change. The searator consists of 2 layers of fibrous visking plus Pellon bags on both positive and negative electrodes. The BB-674( )/U successfully completed its qualification test program for advanced development models of this battery. The qualification test results are presented for shock, vibration, low temperature charge retention, cycle life - high rate tests. As a result of this program, the BB-674( )/U design was considered to have passed qualification testing. Author (GRA)

N72-18057# Army Electronics Command, Fort Monmouth, N.J. Electronics Technology and Devices Lab.
ENGINEERING EVALUATION OF AIRCRAFT BATTERIES
Sylvia Duze Jul. 1971 36 p refs
(DA Proj. 1T6-62705-A-053)
(AD-733289; ECOM-3456) Avail: NTIS CSCL 10/3

Changes in aircraft technology and advances in electronic and electrical equipment design have caused increased demands for electric power. Batteries in the smallest and lightest design must be capable of delivering high rate currents under all ambients for starting power, have good high rate charge acceptance and be available in the fully charged state in case of emergency. The report details all the problem areas, evaluates the various secondary electrochemical systems in terms of aircraft use, describes the redesign efforts of the Military Services, and presents a critique of specifications covering aircraft batteries. Author (GRA)

N72-18058# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.
THE 300 F ROTATING RECTIFIER ALTERNATOR. PHASE 2: DESIGN, FABRICATION, AND TEST OF ALTERNATOR Final Report, Sep. 1965 - Oct. 1971
Alan E. King, William J. Shilling, and Lee C. Carter Wright-Patterson AFB, Ohio AFAPL Oct. 1971 173 p refs
(Contract AF 33(615)-2697; AF Proj. 3145)
(AD-733351; WAED-70.20E; AFAPL-TR-71-76) Avail: NTIS CSCL 10/2

The design, development, fabrication and test of a 3-phase, brushless alternator is described. The alternator is a wound rotor, rotating rectifier machine constructed out of high temperature materials capable of operating in a 300C ambient with radiation cooling only applied. The goal of the development was to establish design feasibility and application experience for the SiC diodes, the dry lubricated bearings and the electrical materials required. Author (GRA)

N72-18245# Academy of Sciences (USSR), Moscow.
THE RADIO COMPLEX, CONTROL SYSTEMS, AND ELECTRIC POWER SUPPLY
V. P. Puchkov, L. L. Puchenko, F. I. Babkov, R. O. Belova, O. G. Ivanov, V. I. Malin, A. S. Makov, I. B. Merkov, Ye. G. Uzkiy, N. A. Zheleznov et al *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 21-29 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

04 BIOSCIENCES

Includes aerospace medicine, exobiology, radiation effects on biological systems; physiological and psychological factors. For related information see also: 05 Biotechnology.

N72-18059*# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.
[METABOLIC, RESPIRATORY, AND CARDIOLOGICAL MEASUREMENTS DURING EXERCISE AND REST]
28 Dec. 1971 112 p refs
(Contract NAS9-7009)
(NASA-CR-115362) Avail: NTIS CSCL 06P

Low concentration effects of CO2 on metabolic respiration and circulation were measured during work and at rest. The relationship between heart rate and metabolic rate is examined, as well as calibration procedures, and rate measurement during submaximal and standard exercise tests. Alterations in acid base and electrolytes were found during exhaustive exercise, including changes in ECG and metabolic alkalosis effects. J.A.M.

N72-18060*# Translation Consultants, Ltd., Arlington, Va.
ELECTROLYTES IN CELLS OF SKELETAL MUSCLES AND MYOCARDIUM IN CONGESTIVE HEART FAILURE
L. Szczepanski Washington NASA Feb. 1972 9 p refs Transl. into ENGLISH from Polski Tygod. Lekar. Wiadomosci Lekar. (Warsaw), v. 21, issue 26, 1966 p 990-992
(Contract NASw-2038)
(NASA-TT-F-14128) Avail: NTIS CSCL 06P

Fragments of abdominal rectus muscle and of the myocardium obtained during autopsy from patients dying from congestive heart failure and from cases of sudden death were studied. The total water content of the muscle, the extracellular and intracellular water, chlorides, sodium, calcium, potassium and magnesium content in fresh muscle and the concentration of sodium, potassium and magnesium in the intracellular water was determined. In congestive heart failure a statistically significant increase of the total and extracellular water content and chlorine and sodium were observed in fresh muscle and a decrease of potassium and magnesium in the fresh muscle and in intracellular water was found. The water and electrolyte content in the myocardium with pathological changes in cases without signs of congestive heart failure was simular to the content in a control group. It was found that the sum of cation concentration in the intracellular water is decreased in cases of congestive heart failure. Author

N72-18061*# Techtran Corp., Glen Burnie, Md.
STIMULATION OF THE ADRENERGIC SYSTEM BY POTASSIUM IONS IN RATS
A. Cession-Fossion Washington NASA Feb. 1972 14 p refs Transl. into ENGLISH from Arch. Intern. Physiol. Biochim. (Liege), v. 73, no. 4, 1965 p 633-645
(Contract NASw-2037)
(NASA-TT-F-14127) Avail: NTIS CSCL 06C

Experiments on rats, partially confirmed on cats, show that potassium ions can stimulate peripheral, medullary adrenal or post-ganglionic orthosympathetic structures. The medullary adrenal stimulation is greatest and is independent of any cholinergic nicotinic mechanism. Details on doses and laboratory techniques are provided. Author

N72-18062*# California Univ., Berkeley. Space Sciences Lab.
ENZYME ACTIVITY IN TERRESTRIAL SOIL IN RELATION TO EXPLORATION OF THE MARTIAN SURFACE Semiannual Progress Report
M. S. Ardakani, R. G. Burns, A. D. McLaren, and A. H. Pukite 1 Jan. 1972 42 p refs
(Grant NGL-05-003-079)
(NASA-CR-125591; SSL-Ser-13-Issue-1; SAPR-15) Avail: NTIS CSCL 06M

Urease activity in soil is persistent for long periods under low water, low temperature, and sterile regimes, and it was suggested that some form of enzyme-protective mechanism exists in soil. Dublin soil was extracted by sonication in water followed by adding a mixture of salts. Urease activity is associated with the organo-mineral complex thus obtained and is resistant to the activities of proteolytic enzymes. Clay free soil organic matter prepared subsequently by filtration also exhibits urease activity which is resistant to proteolysis. Models consisting of enzymes with bentonite and lignin were found to mimic this resistance to proteolysis. A model system is presented which suggests both the origin and location of soil ureases and a reason for their persistence in nature. Author

N72-18063*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Oct. - 31 Dec. 1971
J. E. Campbell Feb. 1972 9 p
(NASA Order W-13411)
(NASA-CR-125659; QPR-27) Avail: NTIS CSCL 06M

A set of conditions in which 90 C was a more lethal temperature than 125 C for the destruction of Bacillus subtilis var. niger was identified as a function of relative humidity, with maximum effectiveness at 100% R.H. A systematic study of the influence of head-space moisture and temperature on the destruction of B. subtilis var. niger is reported. Author

N72-18064*# Food and Drug Administration, Cincinnati, Ohio. Div. of Microbiology.
ECOLOGY AND THERMAL INACTIVATION OF MICROBES IN AND ON INTERPLANETARY SPACE VEHICLE COMPONENTS Quarterly Progress Report, 1 Jul. - 30 Sep. 1971
J. E. Campbell Nov. 1971 11 p ref
(NASA Order W-13411)
(NASA-CR-125658; QPR-26) Avail: NTIS CSCL 06M

Data showing that 90 C was a more effective temperature than 125 C for the destruction of Bacillus subtilis var. niger when the head-space moisture was fixed at 474 micrograms H2O/ml have been confirmed and are summarized. The influence of head-space moisture at 90 C was investigated and it was observed that as the head-space moisture was increased 474 micrograms H2O/ml, there was a corresponding increase in lethality of the system. This moisture level corresponded to 100% relative humidity at 90 C, and additional water in the cans should have had no effect. A profound descrease was observed in the destruction of the organisms when additional water was added. The discontinuity observed in these data is troublesome and must be resolved as the first step in an orderly exploration of low temperature inactivation of B. subtilis var. niger. Author

N72-18065*# Translation Consultants, Ltd., Arlington, Va.
THE PROBLEM: APHANOASCUS ZUKAL OR ANIXIOPSIS HANSEN
G. A. deVries Washington NASA Feb. 1972 18 p refs Transl. into ENGLSH from Mykosen (Berlin), v. 12, no. 2, 1969 p 111-122
(Contract NASw-2038)
(NASA-TT-F-14092) Avail: NTIS CSCL 06M

Aphanoascus Zukal and Anixiopsis Hansen are considered to be two different genera on the basis of the different color and size of the cleistothecia and the late, or early, closure of the peridial wall, whereas Anixiopsis stercoraria Hansen and Anixopsis reticulispora Routien are considered to belong to one species, Anixiopsis fulvescens (Cooke) nov. comb. based on their close similarity. These phenomena are examined in detail. Author

N72-18066*# Missouri Univ., Columbia.
GLC ANALYSIS OF BASE COMPOSITION OF RNA AND DNA HYDROLYSATES
Duane B. Lakings and Charles W. Gehreke 1971 52 p refs
(Grant NGR-26-004-011-S5)
(NASA-CR-125593) Avail: NTIS CSCL 06A

Various methods used for the analysis of the base composition of RNA and DNA hydrolysates are presented. The methods discussed are: (1) ion-exchange chromatography, (2) paper chromatography, (3) paper electrophoresis, (4) thin layer chromatography, (5) paper chromatography and time of flight mass spectrometry, and (6) gas-liquid chromatography. The equipment required and the conditions for obtaining the best results with each method are described. Author

N72-18067# Joint Publications Research Service, Washington, D.C.
HYDRODYNAMICS OF FISH AND DOLPHINS
9 Feb. 1972 17 p refs Transl. into ENGLISH from Zool. Zh. (Moscow), v. 50, no. 11, 1971 p 1686-1694, 1755-1757
(JPRS-55143) Avail: NTIS

The hydrodynamic wake, drag, and vortex formation behind swimming fish and dolphins are studied. For individual titles, see N72-18068 through N72-18069.

N72-18068# Joint Publications Research Service, Washington, D.C.
SOME DISTINCTIONS OF HYDRODYNAMICS OF NEKTON (FISH AND DOLPHINS)
A. N. Lyapin *In its* Hydrodyn. of Fish and Dolphins 9 Feb. 1972 p 1-11 refs (See N72-18067 09-04)
Avail: NTIS

Some nekton swimming in heavy liquids experience considerably less hydrodynamic drag than inanimate solid objects in the range of velocity and immersion depth ratios (Froude numbers) at which manmade apparatus is often subject to vibration and even loss of control. The adaptations of nekton to liquid movement indicate that changes in hydrodynamic pressure rather than in velocity should serve as the basis of liquid and body movement control and, in the broader sense, the basis of their physical interaction. Considering interaction between bodies and liquids as a unique oscillatory process, it is deemed possible to substantiate both the optimum form of a living body as a whole and the possible means of lowering resistance which living organisms use with some success. Author

N72-18069# Joint Publications Research Service, Washington, D.C.
VORTEX FORMATION IN THE HYDRODYNAMIC WAKE OF FISH DURING PROPULSION
O. P. Ovcharov *In its* Hydrodyn. of Fish and Dolphins 9 Feb. 1972 p 12-16 refs (See N72-18067 09-04)
Avail: NTIS

The vortex formation behind moving fish was studied by wake visualization. The results indicate that vortex formation in the wake is related to active function of the locomotor organ. It is observed only when the fish is accelerating and at an established regular velocity. In all cases of breaking there is no vortex formation in the hydrodynamic wake. As the propulsion velocity increases, there is an increase in intensity of vortex formation and an increase in vortical resistance. Author

N72-18070*# Techtran Corp., Glen Burnie, Md.
FLIGHT AND PSYCHOLOGY
V. Levashov and A. Pikovskiy Washington NASA Feb. 1972 5 p refs Transl. into ENGLISH from Grazhdsnskaya Aviatsiya (Moscow), no. 3, Mar. 1970 p 9
(Contract NASw-2037)
(NASA-TT-F-13951) Avail: NTIS CSCL 05J

Investigation of the psychological characteristics of flight and the condition of passengers during flight on commerical airlines are presented. Attention is paid to the elimination of factors which could have a negative psychological influence on the passengers. The effects of positive psychological motivation on crew performance and flight safety are discussed. Author

N72-18071*# Scientific Translation Service, Santa Barbara, Calif.
FURTHER EXPERIMENTAL WORK ON THE RELATION BETWEEN POTASSIUM AND PHYSICAL EXERCISE
M. Mitolo and D. Leone Washington NASA Feb. 1972 10 p refs Transl. into ENGLISH from Boll. Soc. Ital. Biol. Sper. (Naples), v. 43, no. 13, 1967 p 807-810
(Contract NASw-2035)
(NASA-TT-F-14125) Avail: NTIS CSCL 06S

The influence of potassium upon the duration of swimming is investigated. Eight male, white rats were used for the study. It is concluded that potassium lengthens the swimming periods. Author

N72-18072*# Techtran Corp., Glen Burnie, Md.
THE MECHANISM OF REGULATION OF ALPHA-ACETOHYDROXYACID SYNTHETASE PROPERTIES IN BACILLUS CEREUS T.
J. Raimond and N. Grelet Washington NASA Feb. 1972 12 p refs Transl. into ENGLISH from Biochemie (Paris), v. 53, 1971 p 783-788
(Contract NASw-2031)
(NASA-TT-F-14141) Avail: NTIS CSCL 06M

The alpha-acetohydroxyacid synthetase properties in Bacillus cereus T. were studied. According to the results, there is only one enzymatic alpha-acetolactate forming system, operating at pH 7.5. The enzyme is sensitive, in vitro, to valine, leucine, and isoleucine inhibition, the partial inhibitions of leucine and isoleucine being additive and equal to the maximum inhibition caused by valine alone. The Kinetic constants are Km = 0.002 M with respect to pyruvate and Ki = 0.00007 M for valine. A mixed rate and affinity inhibition system for this enzyme is suggested by the kinetic of inhibition. Author

N72-18073# National Research Council of Canada, Ottawa (Ontario).
RADIO WAVES AND THE LIVING ORGANISM
Yu. V. Sebrant and M. P. Troyanskii 1972 34 p refs Transl. into ENGLISH from Biol., Ser. 4 (Moscow), 1969 31 p
(NRC-TT-1519) Avail: NTIS

The possible effects of radio waves, from various sources including natural and instrumental, on humans are examined. The effects of various lengths, frequencies, and time of exposure were also examined. Efforts were made to determine how man can be protected from these waves if indeed they are harmful to him. It was concluded that no specific standards could be set for damage though in some cases damage did occur. Radio waves were also found to be helpful in treating various types of diseases and injuries. E.H.W.

N72-18074*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
THE ESTIMATION OF GALACTIC COSMIC RAY PENETRATION AND DOSE RATES
M. O. Burrell and J. J. Wright Washington Mar. 1972 43 p refs
(NASA-TN-D-6600; M444) Avail: NTIS CSCL 06R

This study is concerned with approximation methods that can be readily applied to estimate the absorbed dose rate from cosmic rays in rads - tissue or rems inside simple geometries of aluminum. The present work is limited to finding the dose rate at the center of spherical shells or behind plane slabs. The dose rate is calculated at tissue-point detectors or for thin layers of tissue. This study considers cosmic-rays dose rates for both free-space and earth-orbiting missions. Author

N72-18075*# Scientific Translation Service, Santa Barbara, Calif.

CHRONIC POTASSIUM DEFICIENCY AND EXCITABILITY OF MUSCLE CELLS. MEASUREMENTS WITH INDIVIDUAL HUMAN MUSCLE CELLS IN SITU

H.-D. Bolte and B. Luederitz Washington NASA Feb. 1972 11 p refs Transl. into ENGLISH from Klin. Wochschr. (Berlin), v. 48, 1970 p 34-36
(Contract NASw-2035)
(NASA-TT-F-14129) Avail: NTIS CSCL 06P

A resting membrane potential of -99.6 mV, a threshold current of 4.37 x 10 to the -8th power A, and a latency time of 27.2 msec. was found in patients with chronic potassium deficiencies of various origins. In comparison to controls in healthy persons, the resting membrane potential was increased by 16.0 mV. The threshold current did not show a statistically significant change. The latency time was increased by more than 100%; i.e., by 15.3 msec. Under the conditions of general potassium deficiency, an increased resting membrane potential is not necessarily linked with an increase of the threshold current or with a decrease in excitability. The increase in the latency time indicates a decrease of the ionic conductivity when the extracellular potassium concentration is diminished in general potassium deficiency. Author

N72-18076*# National Aeronautics and Space Administration, Washington, D.C.

MEDICAL AND BIOLOGICAL PROBLEMS IN THE CONQUEST OF SPACE

V. V. Parin Washington NASA Feb. 1972 15 p Transl. into ENGLISH from Zemlya i Vselennaya (Moscow), no. 3, 1970 p 15-23
(NASA-TT-F-14165) Avail: NTIS CSCL 06E

The medical and biological problems associated with life support systems in a space environment for long periods of time are examined. Subjects discussed are: (1) water and oxygen regeneration, (2) synthesis of food, (3) energy expenditure and conservation, (4) design of life support systems, and (5) biological effects of prolonged space flight. The results of a one year medical and technical experiment at a Soviet Union ground testing facility to study life support systems are presented. Author

N72-18077*# Boeing Co., Seattle, Wash. Space Physics Group.

RADIATION HAZARDS TO MAN

S. B. Curtis (California Univ., Lawrence Radiation Lab.) and M. C. Wilkinson 12 Apr. 1971 46 p refs
(Contract NASw-1963)
(NASA-CR-125592; D180-12878-1) Avail: NTIS CSCL 06R

The secondary dose contribution expected from the heavy primaries of the galactic cosmic rays was evaluated by a calculational technique developed in this study. Improvements in the solar and galactic cosmic ray environments made possible by recent experimental and theoretical work are discussed and presented. The recommendations of the National Academy of Sciences' space radiation study panel, are used in conjunction with a shielding analysis, to evaluate the radiation status of an astronaut during the triple solar particle event of 10, 14, 16 July 1959. Author

N72-18078*# Bellcomm, Inc., Washington, D.C.

USE OF SHUTTLE FOR LIFE SCIENCES

R. E. McGaughy 25 Jan. 1972 24 p refs
(Contract NASw-417)
(NASA-CR-125666; B72-01008) Avail: NTIS CSCL 06B

The use of the space shuttle in carrying out biological and medical research programs, with emphasis on the sortie module, is examined. Detailed descriptions are given of the goals of space life science disciplines, how the sortie can meet these goals, and what shuttle design features are necessary for a viable biological and medical experiment program. Conclusions show that the space shuttle sortie module is capable of accommodating all biological experiments contemplated at this time except for those involving large specimens or large populations of small animals; however, these experiments can be done with a specially designed module. It was also found that at least two weeks is required to do a meaningful survey of biological effects. E.H.W.

N72-18079*# California Univ., Riverside. Dept. of Geography

PLANT TISSUE AND THE COLOR INFRARED RECORD

Robert W. Pease Feb. 1969 20 p refs
(NASA Order R-09-020-024; Contract DI-14-08-0001-10674)
(NASA-CR-125657; USGS-IR-NASA-147) Avail: NTIS CSCL 06C

Green plant tissue should not be considered as having a uniquely high near-infrared reflectance but rather a low visual reflectance. Leaf tissue without chloroplasts appears to reflect well both visual and near infrared wavelengths. The sensitometry of color infrared film is such that a spectral imbalance strongly favoring infrared reflection is necessary to yield a red record. It is the absorption of visual light by chlorophyll that creates the imbalance that makes the typical red record for plants possible. Reflectance measurements of leaves that have been chemically blanched or which have gone into natural chloride decline strongly suggests that it is the rise in the visual reflectance that is most important in removing the imbalance and degrading the red CIR record. The role of water in leaves appears to be that of rendering epidermal membranes translucent so that the underlying chlorophyll controls the reflection rather than the leaf surface. Author

N72-18080*# Stanford Research Inst., Menlo Park, Calif.

SURVEY OF TECHNIQUES USED TO PRESERVE BIOLOGICAL MATERIALS

E. J. Feinler and R. W. Hubbard Jan. 1972 397 p refs
(Contract NAS2-6201; SRI Proj. LSU-8930)
(NASA-CR-114422) Avail: NTIS HC $6.00/MF $0.95 CSCL 06C

The techniques used to preserve biological materials are documented and summarized. The report is presented in a handbook format that categorizes the most important preservation techniques available, and includes a representative sampling of the thousands of applications of these techniques to biological materials and organisms. Details of the information coverage and method of approach are outlined. Data are given in tabular form, and an index and extensive bibliography are included. Author

N72-18081*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif. Biotechnology and Power Dept.

RESULTS OF POST-TEST PSYCHOLOGICAL EXAMINATIONS OF THE CREWMEN FROM THE 90-DAY MANNED TEST OF AN ADVANCED REGENERATIVE LIFE SUPPORT SYSTEM

J. S. Seeman and T. G. MacFarlane (Humboldt State Coll.) Feb. 1972 20 p
(Contract NAS1-10717)
(NASA-CR-112019; MDC-G2827) Avail: NTIS CSCL 06S

The following material presents the results of two temporally remote administrations of an identical projective personality assessment device (Rorschach Inkblot) using crew members aboard the 90-day test. The first administration took place during preselection crew psychodiagnostic testing in the period extending from mid-December 1969 through mid-January 1970. Second administration took place in late May and early June, 1971, approximately one year after termination of the test. During the 90-day program duration, the subjects participated in the crew training program, were selected and served as onboard crew during the 90-day test. The testing was undertaken in order to determine the character and extent of change (if any) in basic personality dynamics accompanying or caused by participation in the 90-day test program. Results indicate that significant personality changes occurred in three of the four onboard crew members. A detailed discussion of the results is provided. Objective scores which served as the basis for the discussion are presented in the Appendix. Author

N72-18082# Joint Publications Research Service, Arlington, Va.

SOME RESULTS OF WORK IN THE FIELD OF SPACE HYDROBIOLOGY AT DNEPROPETROVSK UNIVERSITY (1961-1970)

L. M. Antsyshkina, N. W. Kirilenko, V. Ya. Mamontov, G. B. Melnikov, F. P. Ryabov, and V. T. Khlebas 28 Feb. 1972 9 p refs Transl. into ENGLISH from Gidrobiol. Zh. (Kiev), no. 5, Nov. - Dec. 1971 p 123-127
(JPRS-55284) Avail: NTIS

The problem of creating a closed ecological system (CES) in the cabin of a space ship is discussed. The concept is based on the closed cycle of matter and is connected with the fact that it is advisable to create the foundation for the autotrophic link of the CES on the basis of microscopic unicellular algae. It is concluded that the unification in a single complex of aqueous autotrophic and heterotrophic links of the CES will provide an effective system for sustaining space crews in a closed spacecraft. Author

N72-18083# Joint Publications Research Service, Arlington, Va.

STRESS IN FLIGHT

V. L. Marishchuk, K. K. Platonov, and Ye. A. Pletnitskiy 29 Feb. 1972 103 p refs Transl. into ENGLISH of the book "Napryazhennost v Polete" Moscow, Military Publishing House, 1969 116 p
(JPRS-55306) Avail: NTIS

Certain causes for the occurrence of flight stress are reviewed. Ways of overcoming it are suggested, which were checked in practice. Methods of evaluating the emotional stability of flight personnel are discussed. Author

N72-18084*# Techtran Corp., Glen Burnie, Md.

HEAVY WORK IN MINING FIELDS IN A HOT, DAMP CLIMATE

L. Parmeggiani and C. Sassi Washington NASA Feb. 1972 42 p refs Transl. into ENGLISH from Med. Lavoro (Milan), v. 46, no. 5, May 1955 p 295-324
(Contract NASw-2037)
(NASA-TT-F-14121) Avail: NTIS CSCL 06S

The physical modalities of acclimatization of miners working in extremely hot and humid conditions normally considered impossible to work in are investigated. While individual variations exist, miners adapt themselves to dehydration, work rhythms, water intake, leanness, nakedness, and restricted sweat production which combine to permit effective work. Author

N72-18085# Maryland Univ., College Park. Computer Science Center.

EDGE AND CURVE DETECTION FOR VISUAL SCENE ANALYSIS, 2

Azriel Rosenfield, Mark Thurston, and Yung H. Lee Aug. 1971 87 p ref
(Contract F19628-70-C-0208; AF Proj. 5628)
(AD-733711; SR-5; AFCRL-71-0457) Avail: NTIS CSCL 06/16

Further work is described on simple sets of parallel operations that detect 'texture edges' (abrupt discontinuities in the average values of local picture properties), as well as spots or streaks that are texturally different from their surrounds. GRA

N72-18086# Naval Medical Research Inst., Bethesda, Md.

ULTRASOUND DOSAGE FOR EXPERIMENTAL USE ON HUMAN BEINGS Interim Report

Wesley D. Ulrich Aug. 1971 16 p refs
(AD-731075; NAVMED-M4306-01 0010BXK9-2) Avail: NTIS CSCL 06/18

The safety zone for continuous wave ultrasound lay below a log/log line connecting 1 microsec of 1 kw/sq cm ultrasound with 200 seconds of 100 mw/sq cm ultrasound. An ultrasonic intensity of 100 mw/sq cm or less was also safe for at least 10,000 seconds. Pulsed wave ultrasound was safe for doses in which the average intensity multiplied by the total exposure time lay within this safety zone. The safety zone was valid for 0.5 to 15 MHz and for all anatomic sites except the eyes. Re-exposures were limited to 10 per month and 30 per year. Author (GRA)

N72-18087# School of Aerospace Medicine, Brooks AFB, Tex.

THE EFFECT OF 6-MeV X-RAY ON PLASMA-REDUCING SUBSTANCES IN THE PRIMATE (MACACA MULATTA) Final Report, Oct. 1970 - Mar. 1971

Fred N. Beckman Aug. 1971 16 p refs
(AD-731091; SAM-TR-71-28) Avail: NTIS CSCL 06/18

Experiments were undertaken which demonstrate an early rise (30 to 50 mg. %) of plasma-reducing substances within 14 minutes after the onset of 165 rads/min. of 6-MeV X-irradiation and blockage of this rise by diphenhydramine and alpha-chloralose. It is postulated that the early hyperglycemic response observed in the primate is much more closely related to the cardiovascular changes which occur immediately following ionizing radiation exposure than they are to gluconeogenesis and glycogenesis. Author (GRA)

N72-18088# Aerospace Research Labs., Wright-Patterson AFB, Ohio.

HYPOTENSION DURING BROMOTRIFLUOROMETHANE EXPOSURE Final Report

Ethard W. VanStee and Kenneth C. Back Aug. 1971 23 p refs
(AD-731549; AMRL-TR-68-182) Avail: NTIS CSCL 06/20

Cardiac output and mean arterial blood pressure measurements were performed on anesthetized dogs during exposure to bromotrifluoromethane. Left ventricular end diastolic pressure was recorded from anesthetized open-chested dogs and monkeys during exposure to $CBrF_3$. A significant decrease in total peripheral resistance and myocardial contractility were shown to combine to produce a reversible hypotension during exposure to $CBrF_3$. Author (GRA)

N72-18089# RAND Corp., Santa Monica, Calif.

ON PULSATILE, NON-NEWTONIAN FLOW IN THE MICROCIRCULATION

Jerome Aroesty, Carol Gazley, Jr., and Joseph Gross Dec. 1970 13 p refs Presented at Conf. on the 6th European Microcirculation Soc., Aalborg, Denmark, 22-26 Jun. 1970
(AD-731276; P-4516) Avail: NTIS CSCL 06/16

The flow of a Casson fluid was examined under periodic pressure gradient in a rigid tube, at the low frequency limit. Results show that the quasi-steady solution, where time acts as a parameter and not as an independent variable, can be used to construct accurate solutions for such a flow. These solutions are applicable to the flow of blood in small vessels at low shear rates. As an illustration, the flow under a sinusoidal pressure gradient was computed based on quasi-steady theory. The nonlinear relation between flow and instantaneous pressure gradient was shown by blunting of the flow rate curve, which occurs when the magnitude of the pressure gradient is small. Author (GRA)

N72-18090# Armed Forces Inst. of Pathology, Washington, D.C.

[MILITARY-SPONSORED RESEARCH IN PATHOLOGY] Annual Research Progress Report, 1 Jul. 1970 - 30 Jun. 1971

Bruce H. Smith Jun. 1971 182 p refs
(AD-730340; RCS-MEDDH-288(R1)) Avail: NTIS CSCL 06/5

Summaries are given of the following projects. Studies on

pathogenic amebae; quantitative cytology with the electron microscope: study of malaria growth cycle; research in geographic pathology; urease inhibition; relation to hepatic coma; the biomolecular structure of normal, injured and diseased muscle cells; etiology of viral transitional L forms of the alpha hemolytic streptococcus and chronic stress as etiologic agents; nephropathology research laboratory-experimental study of acute renal failure; effects of prolonged exposure of the retina to low intensity CW laser; and immunopathologic studies of malaria.
GRA

N72-18091# Road Research Lab., Crowthorne (England). Driver Aids and Abilities Section.

SMALL EYE MOVEMENTS AND VISUAL EFFICIENCY

D. C. West 1971 60 p refs
(PB-202995; RRL-LR402) Avail: NTIS CSCL 06P

Previous work by Foley-Fisher showed a close relationship between the frequency of small involuntary eye-movements (saccades) and vernier acuity. The present research is an extension of this work, using randomly selected untrained subjects rather than experienced observers. It was hoped that research would show the saccade frequency/acuity relationship to be good enough for prediction of acuity once the eyemovement parameters were established by objective measurement. The relationships found were so poor that this was not possible. However, the general trend of the results was in agreement with previous work, the best indicator of good vernier acuity being the frequency of inter-saccadic intervals longer than about 1 sec.
Author (GRA)

N72-18092# Naval Submarine Medical Center, Groton, Conn.

HYPERBARIC AIR AND CORNEAL VASCULARIZATION Final Report

Robert J. Kaiser and Donald W. Klopp 24 Jun. 1971 11 p refs
(AD-732398; NSMRL-668) Avail: NTIS CSCL 06/5

Hypoxia is one of the factors postulated as promoting vascularization of the cornea. However, previous experiments designed to increase tissue oxygen for short or intermittent periods have had no effect in retarding neovascularization. The present study utilized rabbit exposure to hyperbaric air for continuous periods of up to two weeks to increase tissue oxygen, and demonstrated no effect on the neovascularization caused by sodium hydroxide burns of the cornea. This confirms previous experimental results and tends to rule out inadequate time periods or intermittency of exposure as factors in previous negative results.
Author (GRA)

N72-18093# Lovelace Foundation for Medical Education and Research, Albuquerque, N.Mex.

COMPARATIVE EFFECTS OF HYPEROXIA AND HYPERBARIC PRESSURE IN TREATMENT OF PRIMARY BLAST INJURY Progress Report

Edward G. Damon and Robert K. Jones Washington Defense Nucl. Agency 1 Mar. 1971 51 p refs
(Contract DA-49-146-XZ-372; DASA Proj. NWER-XAXM)
(AD-731396; DASA-2708) Avail: NTIS CSCL 06/5

Guinea pigs and rabbits were exposed to lethal reflected pressures in an air-driven shock tube and were subsequently treated in a hyperbaric chamber in which the oxygen tension (PO2) and chamber pressure were independently varied. Treatments involving increases in PO2 resulted in increased survival times of guinea pigs whereas pressurization for 30 minutes at 36 or 72 p.s.i.g. with the PO2 retained at the normal ambient level by use of an N2-air mixture had no detectable effect on survival times of the animals. To study the effects of prolonged hyperbaric oxygenation in treatment of blast injury, guinea pigs and rabbits were treated on a 29-hour schedule having an initial 3-hour hold-time at the pressure-treatment level followed by 26 hours for decompression. In rabbits, an initial PO2 of 17.5 p.s.i.a., achieved either by air pressure at 72 p.s.i.g. or by pressurization to 15 p.s.i.g. with 65-percent O2, 35-percent N2, resulted in full survival and recovery of all treated animals. In guinea pigs, treatment with 100-percent O2 at 5.5 p.s.i.g. (PO2 – 17.5 p.s.i.a.) or at 12 p.s.i.g. (PO2 – 24 p.s.i.a.) resulted in increased survival times with no increase in overall survival and recovery in the first case and significantly increased survival and recovery compared to that of untreated controls in the second case. The pathophysiology of primary blast injury is discussed with special reference to the roles of air embolism and cardiopulmonary pathology in the etiology of death.
Author (GRA)

N72-18094# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.

COMBINED EFFECTS OF NOISE AND VIBRATION ON MENTAL PERFORMANCE Final Report, Sep. 1970 - Feb. 1971

C. Stanley Harris and Henry C. Sommer Aug. 1971 22 p refs
(AF Proj. 7231)
(AD-731146; AMRL-TR-70-21) Avail: NTIS CSCL 05/10

Two experiments were conducted to determine the combined effects of noise and vibration on mental performance. In experiment 1, ten subjects were tested on a combination short term memory and subtraction task during exposure to four different intensities of broadband noise. Another group of ten subjects was tested using the same noise intensities in combination with 0.25g (peak) vertical vibration at 5Hz. Noise alone, and vibration with low level noise (80 dB and 90 dB re 0.0002 dyne/sq cm) had no adverse effects on task performance while the highest level of noise (110 dB) combined with vibration to produce a significant reduction in the number of correct responses. In experiment 2, the second group of subjects used in experiment 1 was tested during exposure to the following conditions: no vibration (control), vibration at 5 Hz - 0.25g, 7 Hz - 0.30g, and 11 Hz 0.50g, all combined with 80 dB noise. Subsequently these same vibration conditions were presented with 107 dB noise. High intensity noise and vibration combined to produce a greater decrement in performance than either stressor alone. Vibration at 5 Hz was a more sensitive frequency for mental subtraction performance than 7Hz and 11 Hz when the three frequencies were presented in conjunction with high intensity noise.
Author (GRA)

N72-18095# School of Aerospace Medicine, Brooks AFB, Tex.

EUSTACHIAN TUBE FUNCTION TESTING USING AN ACOUSTIC IMPEDANCE BRIDGE Final Report

Harrell C. Sutherland, Jr., Vernon C. Bragg, and Frederick G. Collins Jun. 1971 25 p refs
(AD-731126; SAM-TR-71-21) Avail: NTIS CSCL 06/19

A procedure for comprehensive testing of eustachian tube function was devised. The test battery was administered to 13 apparently normal subjects, 5 subjects with clinically identified eustachian tube malfunction, and 3 subjects who had experienced ear blocks in an altitude chamber. Results were examined to find what, if any, portions of the test might predict ability to undergo rapid barometric pressure change without experiencing ear block. Neither the whole nor any portion of the procedure was found suitable for screening purposes. However, the tests appear useful in clinical evaluation of eustachian tube function.
Author (GRA)

N72-18096# Naval Aerospace Medical Inst., Pensacola, Fla.

EFFECTS OF DIFFERENT ALCOHOL DOSAGES AND DISPLAY ILLUMINATION ON TRACKING PERFORMANCE DURING VESTIBULAR STIMULATION

Richard D. Gilson, David J. Schroeder, William E. Collins, and Fred E. Guedry, Jr. 26 Jul. 1971 15 p refs
(AD-732444; NAMRL-1140; USAARL-72-2) Avail: NTIS CSCL 06/19

A previous investigation showed that alcohol impairs the ability to suppress vestibular nystagmus, thus degrading visual compensatory tracking performance during angular acceleration. Reduced display illumination, independently, has also been shown to degrade tracking performance during vestibular stimulation. The present study investigated the way in which

low and moderate dosages of alcohol and two levels of instrument-display illumination combined to affect tracking performance a) in a static (no motion) environment, and b) in a dynamic (whole-body motion) environment. Mean blood-alcohol levels as low as 0.027 per cent significantly (p-.05) decreased tracking performance during whole-body motion, yet caused little change in performance in a stationary environment. Impairment was much more pronounced with dim display lighting (0.1 ft-L) than with bright lighting (1.0 ft-L). These results suggest that serious problems may even be encountered by the pilot who drinks lightly and who considers flying, expecially at night.
Author (GRA)

N72-18097# Naval Aerospace Medical Inst., Pensacola, Fla.

NYSTAGMUS RESPONSES DURING TRIANGULAR WAVEFORMS OF ANGULAR VELOCITY ABOUT THE Y AND Z AXES

Richard D. Gilson, Charles W. Stockwell (AERL), and Fred E. Guedry, Jr. Jul. 1971 16 p refs
(AD-731380; NAMRL-1138; USAARL-72-1) Avail: NTIS CSCL 06/19

Nystagmus response parameters were estimated by a test procedure using short triangular waveforms of angular velocity. Mean estimates were determined as follows: II/delta = 15.5 seconds and Kn(phi/delta) = 8.0 seconds for the horizontal semicircular canals, and II/delta = 6.8 seconds and Kn(phi/delta) = 5.4 seconds for the vertical semicircular canals. The II/delta values are consistent with results obtained by other methods. Values of Kn(phi/delta) have not been heretofore assessed. Determination of the effects of stimulus distortion on the values of the response parameters and estimates of intersubject and intrasubject variability are included. Also included are nomograms that permit a simple and accurate method for calculating II/delta and Kn(phi/delta).
Author (GRA)

N72-18098# Naval Air Development Center, Johnsville, Pa. Aerospace Medical Research Dept.

EMPIRICAL LAWS FOR BRIGHTNESS DISCRIMINATION THRESHOLDS AS A FUNCTION OF TIME BETWEEN TWO IDENTICAL FLASH INCREMENTS

Robert M. Herrick 30 Dec. 1970 54 p refs
(Bumed Proj. MF12524004)
(AD-731376; NADC-MR-7021) Avail: NTIS CSCL 06/16

Visual displays of radar, sonar, and other weapons systems devices provide signals that vary in their temporal characteristics. Typically, these temporal characteristics may be manipulated by the operator of the display device to achieve optimal detection or identification of signals. The aim of the research reported here is to determine how two successive visual signals, displayed upon various background fields, interact to influence detectability. The general laws that were devised to describe the results of the experiments have application to any display in which two temporally-spaced signals occur.
Author (GRA)

N72-18099# Denver Univ., Colo.

STUDIES IN INTERSENSORY PROCESSES: EFFECTS OF TIME HISTORY VISUAL DISPLAYS ON BISENSORY INFORMATION PROCESSING Quarterly Report

Joseph Halpern 15 Nov. 1971 4 p
(Contract N00014-67-A-0394-0001; NR Proj. 144-222)
(AD-733092) Avail: NTIS CSCL 05/10

Pilot studies were undertaken to provide some basic parametric information on the Time History Display to permit the development of a series of films which contained no stimuli with easily discriminable cues. The report reviews these studies.
GRA

N72-18100# California Univ., Los Angeles. Brain Research Inst.

CHEMICAL INDEX TO FITNESS Final Report, Sep. 1970 - Aug. 1971

Robert T. Rubin (Pennsylvania State Univ., Hershey) Aug. 1971 4 p
(Contracts N00014-69-A-0200-4030; NR Proj. 108-912)
(AD-732554) Avail: NTIS CSCL 05/10

An investigation of the interrelationships of anterior pituitary hormones in stress situations is presented. The study concerns the release of anterior pituitary hormones in normal young adult men during all-night sleep and dreaming. Plans to continue and extend these studies to determine the characteristics of the release of each of the anterior pituitary hormones in human subjects under a number of conditions of central nervous system activity, including field stress situations are in progress. These studies will also encompass the circadian rhythms of the release of these hormones, an important aspect of anterior pituitary physiology.
GRA

N72-18261# National Research Council of Canada, Ottawa (Ontario). Control Systems Lab.

NONIONIZING ELECTROMAGNETIC RADIATION AND POLLUTION OF THE ATMOSPHERE

J. A. Tanner and C. Romero-Sierra (Queens Univ., Kingston, Ontario) *In its* Div. of Mech. Eng. and the Natl. Aeron. Est. 31 Dec. 1971 p 37-45 refs (See N72-18258 09-11)
Avail: NTIS

05 BIOTECHNOLOGY

Includes life support systems, human engineering, protective clothing and equipment; crew training and evaluation, and piloting. For related information see also: 04 Biosciences.

N72-18101# North American Rockwell Corp., Los Angeles, Calif.

LIFE SUPPORT SYSTEM REQUIREMENTS. VOLUME 3: SECTION 3: ENVIRONMENT DESCRIPTION Final Report

Marvin N. Goldberg, William J. Adams, James W. Raeke, J. R. Plant, and C. E. Jones Wright-Patterson AFB, Ohio ASD Nov. 1970 245 p refs Supersedes AD-880015
(Contract F33657-70-C-0374; AF Proj. 412)
(AD-732015; NA-70-397-Vol-3; ASD-TR-70-47-Vol-3) Avail: NTIS CSCL 06/11

The volume identifies pertinent characteristics of the operational environment, the natural world-wide environment and the induced environment. Data are presented in a manner to clearly define areas having life support systems design implications.
Author (GRA)

N72-18102*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HUMAN PERFORMANCE CAPABILITIES IN A SIMULATED SPACE STATION-LIKE ENVIRONMENT. 1: FIXED BEAM LUMINANCE AND LOCATION

Richard F. Haines, Albert E. Bartz (Concordia Coll.), and Joseph R. Zahn (San Jose State Coll.) Jan. 1972 105 p refs
(NASA-TM-X-62101) Avail: NTIS CSCL 05E

The effects of a fixed, intense, one-foot diameter beam of simulated sunlight imaged within the field of view, upon responses to a battery of visual, body balance and stability, eye-hand coordination, and mental tests were studied. Each subject's electrocardiogram and electro-oculograms (vertical and horizontal) were recorded throughout each two-hour testing period within the space-station-like environment. It is possible to say that both subjects adapted to the brightly illuminated white panels in approximately 30 seconds after their first exposure each day and thereafter did not experience ocular fatigue, eye strain, or other kinds of disturbances as a result of these viewing conditions.
Author

N72-18103*# Battelle Memorial Inst., Columbus, Ohio.
DATA COLLECTION AND PREPARATION OF AUTHORITATIVE REVIEWS ON SPACE FOOD AND NUTRITION RESEARCH Summary Report, 22 Mar. 1971 - 22 Jan. 1972
22 Jan. 1972 38 p refs
(Contract NAS9-11634)
(NASA-CR-115414) Avail: NTIS CSCL 06H

The collection and classification of information for a manually operated information retrieval system on the subject of space food and nutrition research are described. The system as it currently exists is designed for retrieval of documents, either in hard copy or on microfiche, from the technical files of the MSC Food and Nutrition Section by accession number, author, and/or subject. The system could readily be extended to include retrieval by affiliation, report and contract number, and sponsoring agency should the need arise. It can also be easily converted to computerized retrieval. At present the information retrieval system contains nearly 3000 documents which consist of technical papers, contractors' reports, and reprints obtained from the food and nutrition files at MSC, Technical Library, the library at the Texas Medical Center in Houston, the BMI Technical Libraries, Dr. E. B. Truitt at MBI, and the OSU Medical Libraries. Additional work was done to compile 18 selected bibliographies on subjects of immediate interest on the MSC Food and Nutrition Section. Author

N72-18104*# Physiometrics, Inc., Malibu, Calif.
TOLERENCE FOR WORK-INDUCED HEAT STRESS IN MEN WEARING LIQUIDCOOLED GARMENTS Final Report
W. Vincent Blockley and Herman P. Roth Dec. 1971 31 p refs
(Contract NAS9-10961)
(NASA-CR-115420) Avail: NTIS CSCL 05E

An investigation of the heat tolerance in men unable to dispose of metabolic heat as fast as it is produced within the body is discussed. Examinations were made of (a) the effect of work rate (metabolic rate) on tolerance time when body heat storage rate is a fixed quantity, and (b) tolerance time as a function of metabolic rate when heat loss is terminated after a thermal quasi-equilibrium was attained under comfortable conditions of heat transfer. The nature of the physiological mechanisms involved in such heat stress situations, and the possibility of using prediction techniques to establish standard procedures in emergencies involving cooling system failures are also discussed. E.H.W.

N72-18105*# Whirlpool Corp., St. Joseph, Mich. Life Support Systems Group.
DEVELOPMENT OF FREEZE DRIED VEGETABLES
Robert W. Larson Oct. 1970 13 p
(Contract NAS9-9032)
(NASA-CR-115429) Avail: NTIS CSCL 06H

The development of freeze dried vegetables to be used in the Apollo food system is discussed. After the initial selection and screening of vegetables, several types of freeze dried vegetables were prepared in small batches. From these small batches, two vegetables were judged satisfactory for further testing and evaluation. These vegetables, mashed potatoes and asparagus, were subjected to storage at 100 deg plus or minus 5 F. for two weeks and then taste tested. The vegetables were also tested to determine if they complied with the microbiological requirements for Apollo food. The space food prototype production guide for the vegetables is submitted. Author

N72-18106*# Southwest Research Inst., San Antonio, Tex.
SOUTHWEST RESEARCH INSTITUTE ASSISTANCE TO NASA IN BIOMEDICAL AREAS OF THE TECHNOLOGY Final Report, 25 Aug. 1970 - 24 Aug. 1971
David F. Culclasure and Linda Eckhardt 24 Aug. 1971 111 p
(Contract NASw-1867; SwRI Proj. 13-2538)
(NASA-CR-125616) Avail: NTIS CSCL 06B

Significant applications of aerospace technology were achieved. These applications include: a miniaturized, noninvasive system to telemeter electrocardiographic signals of heart transplant patients during their recuperative period as graded situations are introduced; and economical vital signs monitor for use in nursing homes and rehabilitation hospitals to indicate the onset of respiratory arrest; an implantable telemetry system to indicate the onset of the rejection phenomenon in animals undergoing cardiac transplants; an exceptionally accurate current proportional temperature controller for pollution studies; an automatic, atraumatic blood pressure measurement device; materials for protecting burned areas in contact with joint bender splints; a detector to signal the passage of animals by a given point during ecology studies; and special cushioning for use with below-knee amputees to protect the integrity of the skin at the stump/prosthesis interface. Author

N72-18107*# National Aeronautics and Space Administration, Washington, D.C.
HEAVY WORK IN MINE STOPES WITH HOT, HUMID CONDITIONS. FIRST REPORT: FUNCTIONAL ADAPTATION, THERMOREGULATION, AND WATER BALANCE
L. Parmeggiani and C. Sassi Feb. 1972 40 p refs Transl. into ENGLISH from Med. Lavoro (Milan), v. 46, no. 5, May 1955 p 295-324
(NASA-TT-F-14043) Avail: NTIS CSCL 06S

The clinico-functional pattern, particularly the water balance, of 54 miners was studied by means of investigations repeated through different seasons of the year. Pulse, blood pressure and breath were measured at the beginning, after four hours, and at the end of the working shift. Relatively slight modifications were found. Sweating during 8 hours of work reached a maximum of 6.875 kg, varying from a maximum of 1.194 kg to a minimum of 120 g per hour of actual work. In the conditions of elevated humidity considered, the production of sweat is excessive to the effects of thermoregulation. The quantity of sweat is correlated with the quantities of liquid intake during work. Diuresis during work was reduced to very low values, varying from a maximum of 340 ml to a minimum of 0. Density of the urine increases through the effect of work, but the pH presents no significant variations. Urine urea elimination is very low. Creatinine concentration increases in the urine, but the total quantity eliminated is not above the normal. Author

N72-18108*# Environmental Research Associates, Essex, Md.
HYBRID WATER IMMERSION SIMULATION OF MANUAL IVA PERFORMANCE IN WEIGHTLESSNESS
Harry L. Loats, Jr. and G. Samuel Mattingly 15 Dec. 1971 72 p refs
(Contract NAS9-12122)
(NASA-CR-115436; ERA-71-3) Avail: NTIS CSCL 06P

A description is given of the development, tests, and analysis of a manual simulator. The simulator was developed to test mass handling and translation under weightlessness conditions by a test subject. The system is composed of a hybrid simulator with a combination of water immersion and mechanical, Peter Pan, simulation. The concept operates on the equivalence principle, with the subject and the cargo remaining quasi-stationary. Movement is effected through a moving device controlled through force by the subject. Motion response is determined through computations of the inertial movement under such conditions. E.H.W.

N72-18109# Joint Publications Research Service, Washington, D.C.
SELECTION, TRAINING AND COMPATIBILITY OF SPACESHIP CREWS
A. A. Leonov 29 Feb. 1972 6 p Transl. into ENGLISH from Aviatsiya i Kosmonavtika (Moscow), no. 1, 1972 p 30-32
(JPRS-55305) Avail: NTIS

The unusual environment in which space crews live and work determines astronaut selection, training, and compatibility evaluation. Control problems arising in the interaction between man and automatic systems effect task distributions between crew members and personnel selection criteria. Compatibility and mutual understanding are basic for the organization of the spaceship crew. G.G.

N72-18110*# Scientific Translation Service, Santa Barbara, Calif.

SPECTRAL ANALYSIS OF AN ELECTROENCEPHALOGRAM DURING SLEEP AND WAKEFULLNESS

T. N. Oniani, P. P. Molnar, and I. K. Badridze Washington NASA Mar. 1972 6 p refs Transl. into ENGLISH from Soobshch. Akad. Nauk Gruz SSR (USSR), v. 57, no. 1, 1970 p 173-176
(Contract NASw-2035)
(NASA-TT-F-14172) Avail: NTIS CSCL 06B

Different cortical rhythms, recorded with the use of chronically implanted electrodes in several phases of the sleep-arousal continuum, were investigated by the method of spectral analysis and integration. During spontaneous, as well as evoked (by alimentary conditioned signal or by electrical stimulation of the reticular formation) arousal, high voltage slow waves (delta, theta and alpha) were found to be inhibited in different enocortical territories, and for a short period in the hippocampus as well. In place of the generally reported increase of the low voltage fast activity components a decrease in these rhythms was found. Author

N72-18111*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONVERSION OF CARDIAC PERFORMANCE DATA IN ANALOG FORM FOR DIGITAL COMPUTER ENTRY

Robert L. Miller Washington Mar. 1972 9 p refs
(NASA-TM-X-2519; E-6731) Avail: NTIS CSCL 06B

A system is presented which will reduce analog cardiac performance data and convert the results to digital form for direct entry into a commercial time-shared computer. Circuits are discussed which perform the measurement and digital conversion of instantaneous systolic and diastolic parameters from the analog blood pressure waveform. Digital averaging over a selected number of heart cycles is performed on these measurements, as well as those of flow and heart rate. The determination of average cardiac output and peripheral resistance, including trends, is the end result after processing by digital computer. Author

N72-18112# Civil Aeromedical Inst., Oklahoma City, Okla.

DISCRIMINATION OF SHORT DURATION (TWO PULSE) FLASHES AS A FUNCTION OF SIGNAL LUMINANCE AND METHOD OF MEASUREMENT

Henry W. Mertens and Mark F. Lewis Nov. 1971 6 p refs
(FAA-AM-71-42) Avail: NTIS

The detection of the minimum-duration dark interval between signal light pulses was investigated as a function of signal luminance and the psychophysical method of measurement. The theory of signal detectability (TSD) prediction that observer sensitivity is independent of the psychophysical method was tested. Discrimination with the forced choice procedure was studied at three luminance levels: 31.8, 318, and 3183 candelas per square meter. Author

N72-18113# Civil Aeromedical Inst., Oklahoma City, Okla.

AIR TRAFFIC APTITUDE TEST MEASURES OF MILITARY AND FAA CONTROLLER TRAINEES

Bart B. Cobb Oct. 1971 32 p refs
(FAA-AM-71-40) Avail: NTIS

This study concerns the experimental use of seven commercially published aptitude tests at air traffic control training schools, the determination of relationships between the aptitude scores and training-course performance measures of Army, Air Force, Marine Corps, and Navy students, and an assessment of the potential with which such aptitude measures might be used to improve the military ATC-selection programs. Results indicate that a composite score involving only four of the tests could have been used with considerable effectiveness to predict military ATC-training performance. However, other findings illustrate that such tests are of relatively little value for secondary screening purposes compared to a simple change in the military-screening-and-classification standards; specifically precluding the selection of Army, Navy, and Marine Corps personnel having MSC aptitude indexes below 115 and of Air Force candidates having a general index of less than 70. Author

N72-18114*# Hayes International Corp., Huntsville, Ala.

BIODETECTION GRINDER Final Report

C. D. Shaia and G. H. Jones 21 Dec. 1971 34 p refs
(Contract NAS8-21809)
(NASA-CR-123539; TR-MD-518) Avail: NTIS CSCL 06B

Work on a biodetection grinder is summarized. It includes development of the prototype grinder, second generation grinder, and the production version of the grinder. Tests showed the particle size distribution was satisfactory and biological evaluation confirmed the tests. Author

N72-18115# Illinois Univ., Urbana. Aviation Research Lab.

EFFECTS OF THE MAN ON THE TASK IN COMPLEX MAN-MACHINE SYSTEMS

Charles L. Hulin and Kenneth M. Alvares Feb. 1971 14 p refs
(Contract F41609-70-C-0027; AF Proj. 1123)
(AD-732613; AFHRL-TR-71-7) Avail: NTIS CSCL 05/8

This research tested the hypothesis that in a complex man-machine system one of the many influences on the system is the man's constant reorganization of the tasks which constitute the system. The performances of 67 male college students receiving basic flight training were assessed by means of check rides at three different points of training. Factor analyses of each set of check ride data indicated systematic changes occurred in the structure of the task. A three-factor solution appeared in the 10-hour data, two factors were being assessed by the 25-hour point, and only one general factor appeared in the 35-hour data. This finding indicates that future man-machine systems research should no longer be designed under a fixed-task assumption. It is speculated that this assumption may be one cause of the generally found weak prediction of system performance effectiveness over meaningful intervals of time. Author (GRA)

N72-18116# Michigan Univ., Ann Arbor. Highway Safety Research Inst.

MATHEMATICAL SIMULATION OF DAISY TRACK HUMAN VOLUNTEER TESTS Final Report, Aug. 1969 - Dec. 1970

D. H. Robbins, R. G. Snyder, and V. L. Roberts Jul. 1971 64 p refs
(Contract DOT-FH-11-6962)
(PB-203717; HSRI-Bio-M-71-6; DOT-HS-800573) Avail: NTIS CSCL 13L

A study has been conducted as an initial step in determining the differences observed between the motions of a living human impact sled test subject and a dummy test subject. A series of measurements were taken on human test subjects including classical and non-classical anthropometric measurements, range of motion measurements for the joints, and maximum foot force measurements. A series of mathematical expressions have been used to predict body segment weight, centers of gravity, and moments of inertia using the results of the various body measurements. A computer simulation of an impact sled test involving a human volunteer was made. Author

N72-18117# Smith-Kline Instruments, Inc., Palo Alto Calif.

DEVELOPMENT OF MINIATURE CAPACITANCE PRESSURE TRANSDUCERS Annual Report, Jul. 1968 - Dec. 1970

T. Rees, D. Russell, D. Woody, T. Finnegan, and M. Kientiz 25 Mar. 1971 97 p refs
(Contract PH-43-68-666)
(PB-201938; PH-43-68-666-F) Avail: NTIS CSCL 06B

Techniques were developed to simplify the manufacture of ultraminiature capacitive pressure transducers for physiological measurements. The transducers are of two types. The first is .046 inches in diameter, (1.17 mm), and is mounted at the tip of a four-foot catheter cable. An airway inside the catheter allows the direct measurement of relative pressures. Significant advances were made on all parts of the system. Author (GRA)

N72-18118# Navy Clothing and Textile Research Unit, Natick, Mass.

MECHANISM OF THE BRADY CARDIA OF THE DIVING SYNDROME AS SEEN IN DIVERS USING SCUBA IN WATER OF 55, 45, AND 35 DEG F

Dale A. Reins Aug. 1971 18 p refs

(AD-731675; TR-96) Avail: NTIS CSCL 06/19

Physiologists monitored heart rates of test subjects using SCUBA gear under water. Comparisons were made between heart rates immediately before and after subjects entered the water, and at 5-minute intervals while they were immersed in water. Data showed a difference in percent of decrease when initial heart rates were 90 and above or less than 90. However, data showed the decrease to be maximal within 5 minutes of submersion within a return towards presubmersion levels after 30 minutes. It is believed that initial heart rate changes were brought about immediately by a reflex vagal response to immersion. Increased venous return due to water pressure is the apparent cause of the longer term effect. A physiological adaptation to the pressure allowed return towards control values by the end of the 30-minute period. Author (GRA)

N72-18119# TRW Systems Group, Redondo Beach, Calif.

MARINE RESOURCES SPECTROMETER EXPERIMENT Final Report

R. C. Ramsey 29 Nov. 1971 89 p

(Contract N62306-71-C-0153)

(AD-733685) Avail: NTIS CSCL 06/3

Spectral contrast ratios in the visible region of the spectrum between the radiance from fish schools and adjoining water, were obtained by an airborne spectrometer. Most of the data presented are of menhaden just after capture in a purse seine, and of natural mullet schools. These data were taken from a helicopter near the Mississippi Delta. Additional data for natural anchovy schools were obtained off the9 coast of Southern California from a seaplane. A repeatable signature for the mullet was definitely established. Useful contrast ratios were not obtained for the menhaden or anchovy schools. For the menhaden, this was due to the muddy water caused by seining operations. Author (GRA)

N72-18120# Dunlap and Associates, Inc., Santa Monica, Calif. Western Div.

HUMAN FACTORS RESEARCH ON CARRIER LANDING SYSTEM PERFORMANCE Final Report, 1966 - 1971

Clyde A. Brictson Jul. 1971 22 p refs

(Contract N00014-70-C-0202; NR Proj. 197-007)

(AD-733703) Avail: NTIS CSCL 05/9

A five-year program of human factors research on carrier landing performance is summarized. Empirical measures of day and night final approach to landing were recorded and used to describe differences in landing performance across a wide variety of aircraft, ship, pilot, LOS and environmental conditions. The empirical data were used to develop carrier landing performance criteria which were applied to evaluate and assess the relative influence of system components on carrier landing system effectiveness. Carrier landing accident data for 1965-1970 are briefly reviewed and referenced. Studies covering the prediction of touchdown performance from approach data and pilot night landing proficiency from training measures are also summarized. A listing of all technical reports published during the research program is provided. Author

N72-18121# Royal Naval Personnel Research Committee, London (England).

THE PREDICTION OF SAFE EXPOSURE TIMES FOR MEN WORKING IN THERMALLY SEVERE ENVIRONMENTS

C. R. Bell, M. J. Crowder, and J. D. Walters Oct. 1970 43 p refs Prepared for the Environ. Subcomm. of the Roy. Naval Personnel Res. Comm.

(AD-732019; ES-5; NSTIC-31267) Avail: NTIS CSCL 06/19

From a series of investigations begun in 1962 data have been collected on the times to imminent heat collapse of engine-room personnel, dressed in underpants, denim overalls, socks and shoes, and working at approximately 310 J/sec in extremely hot environments. The knowledge gained about individual differences in times to imminent heat collapse enabled nomograms and tables to be produced which permit durations of exposure to be determined within which a known proportion of exposees would be safe from the hazards of imminent heat collapse. Author (GRA)

N72-18122# Illinois Univ., Urbana. Aviation Research Lab.

AN EVALUATION OF THREE POSSIBLE EXPLANATIONS OF THE TEMPORAL DECAY IN PREDICTING PILOT PROFICIENCY

Charles L. Hulin and Kenneth M. Alvares Feb. 1970 25 p refs

(Contract F41609-70-C-0027; AF Proj. 1123)

(AD-731191; AFHRL-TR-71-5) Avail: NTIS CSCL 05/9

The fact that Air Force pilot selection tests do not adequately predict pilot success in operational tactical units is consistent with the generally reported finding that correlations between ability measures and performance decrease over time. This effort investigated the validity of three explanations for this predictive decay: tasks are restructured during training, basic abilities are altered as a function of training, and both of these changes occur. Two groups of students were administered an extensive battery of ability tests at the beginning and again at the end of a 16-week period. The experimental subjects received basic flight training during this interval, whereas the control subjects did not. Support for the third hypothesis resulted from appropriate comparisons between the groups: pretest and posttest scores on ability measures, as well as analysis of the experimental group's flight training performance. The implication of this finding for both selection and training research is discussed.
Author (GRA)

N72-18123# School of Aerospace Medicine, Brooks AFB, Tex.

HEARING OF YOUNG AIRMEN ENTERING NOISE EXPOSURE CAREER FIELDS Progress Report, Nov. 1970 - Jun. 1971

Harrell C. Sutherland, Jr., Donald C. Gasaway, and James F. Boyer, Jr. Aug. 1971 12 p refs

(AF Proj. 7755)

(AD-731131; SAM-TR-71-36) Avail: NTIS CSCL 06/14

Median hearing levels were determined for 225 young airmen who were entering training for occupations involving exposure to potentially hazardous noise. The values were extracted from hearing conservation data forms received from Sheppard AFB, Texas. The medians were compatible with those reported for three other groups of young adult men. These median hearing levels were determined to establish an appropriate reference for assessing the hearing of individuals exposed to potentially hazardous noise. Author (GRA)

N72-18124# Human Engineering Labs., Aberdeen Proving Ground, Md.

REACTION TIME: A BIBLIOGRAPHY WITH ABSTRACTS. SUPPLEMENT 1, WITH INDEX FOR ENTIRE BIBLIOGRAPHY Technical Report, period ending 31 Dec. 1970

Lawrence E. Symington Jul. 1971 103 p refs

(AD-731471) Avail: NTIS CSCL 05/10

The bibliography is an extension of A. S. Kamlet, and L. J. Boisvert, Reaction Time: A bibliography with abstracts. It is a compilation of 351 abstracted references dealing with reaction time in selected human information-processing tasks through

December 1970. The references are arranged in alphabetical order by author. An alphabetic index of pertinent parameters of investigation for the 891 references of both this extension and the original bibliography is also provided. Author (GRA)

N72-18125# Systems Technology, Inc., Hawthorne, Calif.
DISPLAY FORMAT EFFECTS ON PRECISION TRACKING PERFORMANCE, DESCRIBING FUNCTIONS, AND REMNANT Final Report, Aug. 1969 - Mar. 1971
Henry R. Jex, R. Wade Allen, and Raymond E. Magdaleno Aug. 1971 145 p refs
(Contract F33615-69-C-1808; AF Proj. 7184)
(AD-731580; STI-TR-191-1; AMRL-TR-71-63) Avail: NTIS CSCL 05/10

As part of a program to develop a comprehensive theory of manual control displays, six display formats were used by three instrument-rated pilots to regulate against random disturbances with a controlled element of Y sub c = K/s(s + 2), under both foveal and 10 deg parafoveal viewing conditions. The six display formats were: CRT line, CRT thermometer bar, 14-Bar quantized on a CRT, a rotary dial and pointer, and two variations of a moving scale tape-drive (C-141 VSI). All were scaled to equivalent movement and apparent brightness. Measures included overall performance, describing functions, error remnant power spectra, critical instability scores, and subjective display ratings. Other controlled elements and parafoveal angles were partially investigated. The results show that the main effect of display format is on the loop closure properties. Author (GRA)

N72-18126# Illinois Univ., Urbana. Aviation Research Lab.
THREE EXPLANATIONS OF TEMPORAL CHANGES IN ABILITY-SKILL RELATIONSHIPS: LITERATURE REVIEW AND THEORETICAL ANALYSIS
Charles L. Hulin and Kenneth M. Alvares Williams AFB, Ariz. AF Human Resources Lab. Feb. 1971 25 p refs
(Contract F41609-70-C-0027; AF Proj. 1123)
(AD-732612; AFHRL-TR-71-6) Avail: NTIS CSCL 05/9

The empirical and theoretical literature relevant to the temporally decreasing predictive relationship between ability measures and complex motor task performance are reviewed. An extensive historical review of complex motor skill learning revealed that two distinct theoretical models have been advanced. Both of these models, the changing task and the changing subject models, adequately account for this predictive decay. One model assumes that changes occur within the task structure. The other assumes that the ability levels themselves change within a fixed task structure. A third model is presented, a combination of the first two, and the need for empirical evidence allowing a choice among the three models is discussed. Author (GRA)

N72-18127# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
BIOELECTRIC CONTROL: MAN AND AUTOMATIC SYSTEMS (SELECTED ARTICLES)
E. A. Andreeva, M. A. Alekseev, A. M. Eliner, L. V. Ckhaidze, and B. V. Petrovskii 24 Sep. 1971 199 p refs Transl. into ENGLISH from the book "Bioelektricheskoe Upravlenie. Cheloveki Avtomaticheskie Sistemy" Moscow, Izd-vo Nauka, 1970 p 57-66, 241-264, 278-308, 501-573
(FTD Proj. 60101)
(AD-734053; FTD-MT-24-28-71) Avail: NTIS CSCL 05/8

Contents: A study of the mechanisms of control of muscular activity; The characteristics of control of the successive systems of the motor reactions of man; The prediction of the results of action in the control of complex biomechanical systems; The question of differential equations of movements of the extremities of man under the conditions of weightlessness and during overloads; Providing the vitally important functions of an organism as the basis of automatic control of an artificial heart; Biological control of artificial respiration and blood circulation; The development of methods for the construction and evaluation of systems of information presentation; The principles of construction of complexes for continuous control of the human body and automatic normalization of its states; Human engineering problems in the construction of major systems; The heuristic aspects of the problem man and major systems: Heuristic programs for the making of decisions. GRA

06 CHEMISTRY

Includes chemical analysis and identification (e.g., spectroscopy). For applications see: 17 Materials, Metallic; 18 Materials, Nonmetallic; and 27 Propellants.

N72-18128*# Scientific Translation Service, Santa Barbara, Calif.
SEMIQUANTITATIVE CHEMICAL ANALYSES BY MASS SPECTROGRAPHY USING PHOTON BOMBARDMENT IONIZATION (RUBY LASER)
J. F. Eloy Washington NASA Feb. 1972 20 p refs Transl. into ENGLISH, from Intern. J. Mass Spectrometry Ion Phys., v 6, 1971 p 101-115
(Contract NASw-2035)
(NASA-TT-F-14133) Avail: NTIS CSCL 07D

A single-focusing mass spectrograph source permits a record to be made, on a photoplate, of low energy ions obtained directly from a sample on which the focused beam of a ruby laser impinges. The small size of the crater allows the application of this apparatus to the microanalysis of surfaces and particularly to the determination of inclusions. Progress in the use of the laser and apparatus techniques have permitted some applications: analysis of miscellaneous samples, metals or insulators. Experiments show the narrow spread of ionization sensitivity factors for the following elements: Cu, Ni, Cr, S, Mg, Al. An interesting application is the analysis of small mineral inclusions in ores. The threshold of detection is about 0.5 - 0.1% with one laser shot. The accuracy of atomic ratio determination is better than + or - 20%. Author

N72-18129*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
NEW METHODS FOR PREPARING N,NDIALKYLTRIFLUOROACETAMIDES
Li-Chen Hsu 14 Feb. 1972 23 p refs Presented at Middle Atlantic Regional Meeting of the Am. Chem. Soc., Philadelphia, 14-17 Feb. 1972
(NASA-TM-X-68005; E-6777) Avail: NTIS CSCL 07D

The customary preparative methods for N,N-dialkyltrifluoroacetamides involve the acylation of an amine by trifluoroacetic acid or its derivatives. The synthesis of N,N-dialkyltrifluoroacetamides by reacting trifluoroacetic anhydride or acid with disubstituted formamides and acetamides is discussed. These reactions were interpreted with the aid of gas chromatographic analysis. Different reaction mechanisms are proposed for the reactions of formamides and acetamides with trifluoroacetic anhydride or acid. The use of the proposed reaction mechanisms for the synthesis of other fluorinated compounds is discussed. Author

N72-18130*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
ADDITION-TYPE POLYIMIDES FROM SOLUTIONS OF MONOMERIC REACTANTS
P. Delvigs, T. T. Serafini, and G. R. Lightsey 1972 15 p refs Proposed for presentation at 17th Natl. Symp. of the Soc. of Aerospace Mater. and Process Engr., Los Angeles, 11-13 Apr. 1972
(NASA-TM-X-68011; E-6750) Avail: NTIS CSCL 07C

The monomeric reactants approach was used to fabricate addition-type polyimide/graphite fiber composites with improved mechanical properties and thermal stability characteristics over those of composites derived from addition-type amide acid

prepolymers. A screening study of 24 different monomer combinations was performed. The results of a more extensive investigation of a selected number of monomer combinations showed that the combination providing the best thermomechanical properties was 5-norbornene-2.3-dicarboxylic acid monomethyl ester/4,4(')-methylenedianiline/3,3(')4,4(')-benzophenonetetracarboxylic acid dimethyl ester at a molar ratio of 2/3.09/2.09.
Author

N72-18131# Bureau of Mines, Amarillo, Tex. Helium Operations Technical Services Unit.
VAPOR-LIQUID EQUILIBRIA DATA FOR TWO HELIUM-NITROGEN-METHANE MIXTURES FROM 76.5 TO 164 K AND PRESSURES TO 1200 PSIA
Harold L. Rhodes, Lowell Stroud, and Philip C. Tully 1972 32 p refs
(BM-RI-7598; LC-622.06173; TN23.U7; Dewey-7598) Avail: NTIS

Vapor-liquid equilibria data for 65-34-1 and 25-27-48 mole percent helium-nitrogen-methane mixtures are presented for 12 temperatures from 76.5 to 164 K and pressures from 100 to 1200 psia. These data were obtained in a windowed phase equilibrium cell equipped with a vapor recirculating pump. Isobaric and isothermal K values were plotted for both mixtures. Two isometric plots are included. Author

N72-18132# Lockheed Missiles and Space Co., Palo Alto, Calif.
PHOTOCHEMICAL EQUILIBRIUM IN THE PHOTOLYSIS OF O2 AND AN O2 PLUS M MIXTURE IN THE SPECTRAL RANGE LAMBDA > 1550A; M EQUALS He, Ar, N2, CO2
L. G. Karpov and A. M. Privalov [1971] 5 p refs Transl. into ENGLISH from Khim. Vys. Energ. (Moscow), v. 5, no. 6, 1971 p 483-486
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The results are presented for studies of the photolysis of O2 and of mixtures of O2 + M (M = He, Ar, Xe, N2, CO2) at wavelengths greater than 1550 A under photochemical equilibrium conditions. The estimation of the influence of reactions on the magnitude of the steady-state ozone concentration is considered. It was concluded that the difference observed in the photolysis of the mixture O2 + O3 and the steady-state ozone concentration is a result of O3 photolysis in the spectral range studied and of ozone destruction on the walls of the photochemical cuvette. K.P.D.

N72-18133*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
MONTE CARLO ANALYSIS OF LOBULAR GAS-SURFACE SCATTERING IN TUBES APPLIED TO THERMAL TRANSPIRATION
Jerry D. Smith and Charles A. Raquet Washington Mar. 1972 46 p refs
(NASA-TN-D-6700; E-6591) Avail: NTIS CSCL 07D

A model of rarefied gas flow in tubes was developed which combines a lobular distribution with diffuse reflection at the wall. The model with Monte Carlo techniques was used to explain previously observed deviations in the free molecular thermal transpiration ratio which suggest molecules can have a greater tube transmission probability in a hot-to-cold direction than in a cold-to-hot direction. The model yields correct magnitudes of transmission probability ratios for helium in Pyrex tubing (1.09 to 1.14), and some effects of wall-temperature distribution, tube surface roughness, tube dimensions, gas temperature, and gas molecular mass. Author

N72-18134*# Brigham Young Univ., Provo, Utah.
STUDIES OF REACTION GEOMETRY IN OXIDATION AND REDUCTION OF THE ALKALINE SILVER ELECTRODE Final Report
Eliot A. Butler and Angus U. Blackham 13 Sep. 1971 108 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952268)
(NASA-CR-125637) Avail: NTIS CSCL 07D

Two methods of surface area estimations of sintered silver electrodes have given roughness factors of 58 and 81. One method is based on constant current oxidation, the other is based on potentiostatic oxidation. Examination of both wire and sintered silver electrodes via scanning electron microscopy at various stages of oxidation have shown that important structural features are mounds of oxide. In potentiostatic oxidations these appear to form on sites instantaneously nucleated while in constant current oxidations progressive nucleation is indicated.
Author

N72-18135*# California Univ., Berkeley. Sea Water Conversion Lab.
STUDY OF PERMEABILITY CHARACTERISTICS OF MEMBRANES Quarterly Report
K. S. Spiegler, R. M. Messalem, R. J. Moore, and J. Leibovitz 15 Jul. 1971 23 p refs Prepared for JPL
(Contracts NAS7-100; JPL-952109)
(NASA-CR-125635; QR-14) Avail: NTIS CSCL 07D

Pressure-permeation experiments were performed with the concentration-clamp cell. Streaming potentials and hydraulic permeabilities were measured for an AMF C-103 cation-exchange membrane bounded by 0.1 N NaCl solutions. The streaming potential calculated from the slope of the recorded potential differences versus the applied pressure, yields a value of 1.895 millivolt/dekabar. When comparison with other membranes of similar characteristics could be made, good agreement was found. The values of the hydraulic permeability varied somewhat with the applied pressure difference and are between 1.3 x 10 to the minus 8th power and 3.9 x 10 to the minus 8th power sq cm/dekabar-sec. The specific hydraulic permeabilities were also calculated and compared with data from the literature. Fair agreement was found. The diffusion coefficient of the chloride ion in the AMF C-103 membrane was calculated, using Fick's first law of diffusion based on ion concentrations calculated from the Donnan equilibrium concentration of Cl(-). Author

N72-18136*# General American Transportation Corp., Niles, Ill. Research Div.
VACUUM DISTILLATION: VAPOR FILTERED-CATALYTIC OXIDATION WATER RECLAMATION SYSTEM UTILIZING RADIOISOTOPES Final Report, Mar. 1969 - Jun. 1971
R. J. Honegger, G. A., Remus and E. K. Kurg Nov. 1971 69 p refs
(NASA Order T-80498; Contract F33615-69-C-1486; AF Proj. 6373)
(NASA-CR-125675; GARD-1490-0900; AMRL-TR-71-79) Avail: NTIS CSCL 07D

The development of a functional model water reclamation system is discussed. The system produces potable water by distillation from the urine and respiration-perspiration condensate at the normal rate generated by four men. Basic processes employed are vacuum distillation, vapor filtration, vapor phase catalytic oxidation, and condensation. The system is designed to use four 75-watt isotope heaters for distillation thermal input, and one 45-watt isotope for the catalytic oxidation unit. The system is capable of collecting and storing urine, and provides for stabilizing the urine by chemical pretreatment. The functional model system is designed for operation in a weightless condition with liquid-vapor phase separators for the evaporator still, and centrifugal separators for urine collection and vapor condensation. The system provides for storing and dispensing reclaimed potable water. The system operates in a batch mode for 40 days, with urine residues accumulating in the evaporator. The evaporator still and residue are removed to storage and replaced with a fresh still for the next 40-day period. Author

N72-18137# Joint Publications Research Service, Arlington, Va.
FORMATION OF AMINO ACIDS ON IRRADIATION OF FOG CONTAINING FORMALDEHYDE AND AMMONIUM NITRATE WITH UV LIGHT

T. Ye. Pavlovskaya, T. A. Telegina, A. V. Sokolskaya, and I. Ye. Elpiner 29 Feb. 1972 7 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Ser. Biol. (Moscow), no. 6, 1971 p 922-925
(JPRS-55304) Avail: NTIS

One of the possible ways of the abiogenetic formation of biologically important materials under the conditions of the primordial earth as well as under extraterrestrial conditions could have been the photochemical processes occurring in fogs, raindrops, and in clouds. Experimental data obtained by simulating these conditions are reported. The fog consisting of formaldehyde, ammonium nitrate and water was obtained by means of an ultrasonic generator and irradiated with 254 nm UV light. Glycine, alanine, and possibly threonine were identified among the photosynthetic products. Author

N72-18138# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ABSOLUTE OSCILLATOR STRENGTHS FOR THE COPPER RESONANCE LINES Final Report
Thomas M. Bieniewski and Thomas K. Krueger Aug. 1971 36 p refs
(AF Proj. 7114)
(AD-733323; ARL-71-0135) Avail: NTIS CSCL 07/4

The method of total absorption was employed to obtain the absolute oscillator strengths for the resonance lines of copper. The same values were also calculated using Hartree-Fock Self-Consistent Field radial wave functions and the frozen core approximation and then compared with experiment. Author (GRA)

N72-18139# Aerospace Corp., Hawthorne, Calif. Lab. Operations.
FORMATION OF H(2p) AND H(2s) IN COLLISIONS OF 1-25 keV HYDROGEN ATOMS WITH THE RARE GAS, AUGUST 1970 - JULY 1971
J. H. Birely and R. J. McNeal 15 Sep. 1971 45 p refs
(Contract F04701-71-C-0172)
(AD-733332; TR-0172(9260-01)-4; SAMSO-TR-71-259) Avail: NTIS CSCL 07/4

Cross sections have been measured for the emission of Lyman-alpha radiation in collisions of 1-25 keV hydrogen atoms with He, Ne, Ar, Kr and Xe owing to excitation of the fast atom to the 2p and 2s states. The intensity of Lyman-alpha emitted spontaneously from collisionally-excited H(2p) was measured at 54.7 deg. or 125.3 deg. with respect to the H beam in an essentially field-free collision chamber with an oxygen-filtered photometer calibrated by reference to previous results for H(-) on Ar. After a small correction for cascade effects the data yield the cross sections for population of the 2p state in these collisions. An electric field, oriented in the direction of the beam, was applied within the collision chamber to quench collisionally excited H(2s), and the resulting increase in Lyman-alpha radiation has been used to derive the cross sections for formation of the 2s state. The results are compared with previous measurements made at higher energies and with theoretical estimates of these cross sections. The present extension of previous results to lower energy has revealed new structure in the energy dependence of the cross sections for the heavier targets. Existing theoretical treatments of these collisions fail to yield either the magnitude or energy dependence of the cross sections at energies below 5 keV. Author (GRA)

N72-18140# Army Foreign Science and Technology Center, Charlottesville, Va.
POLYMETHYLMETHACRYLATE
D. P. Krindach, N. P. Novikov, and Yu. I. Yudin 20 Oct. 1971 12 p refs Transl. into ENGLISH from Mekh. Polim. (USSR), no. 2, 1968 p 292-287
(AD-733614; FSTC-HT-23-1155-71) Avail: NTIS CSCL 07/5

The rupture of polymethylmethacrylate under the influence of continuous, powerful (up to 20 w) radiation at a wavelength of 10.6 microns was studied. The dependence of the rate of motion of the crater on time of application is established. Theoretical estimates of the rate of motion and depth of the crater are presented on the basis of the thermobalance equation, which correspond to experimentally measured rates. GRA

N72-18141# Aeronutronic, Newport Beach, Calif. Aeronutronic Div.
ABSORPTION AND EMISSION BY SO2 BETWEEN 1050 AND 1400/CM (9.5-7.1 MICRONS) Final Technical Report
Darrell E. Burch, John D. Pembrook, and David A. Gryvnak Jul. 1971 59 p refs
(Contract EPA-68-02-0013)
(PB-203523; U-4947; APTD-0760) Avail: NTIS CSCL 07B

The absorption by the V (1) (1151.38/cm) and V (3) (1361.76/cm) bands of SO2 was studied between 1050 and 1400/cm (9.5-7.1 micrometers). Spectral curves of transmittance were scanned with approximately 1cm resolution for more than 200 samples varying in temperature from about 296 to 575 K and in pressure from 0.01 to 16 atm. The objective was to provide data on SO2 absorption and emission that are required to interpret data obtained on the emission by smokestack exhausts containing SO2. An extensive table provides information from which the emission between 1050 and 1250/cm can be calculated for temperatures between 296 and 650 K. The V (1) band was emphasized. Author (GRA)

N72-18142# Florida Univ., Gainesville. Dept. of Chemistry.
STRUCTURE AND PROPERTIES OF HIGH TEMPERATURE SPECIES RELATED TO ABLATIVE RE-ENTRY AND SOLID PROPELLANTS Final Report, 1 May 1968 - 31 Oct. 1971
William Weltner, Jr. 31 Oct. 1971 18 p refs
(Grant AF-AFOSR-1588-68; AF Proj. 9537)
(AD-733367; AFOSR-71-3005TR) Avail: NTIS CSCL 07/4

The report describes electron-spin-resonance (ESR) and optical spectroscopic investigations of high-temperature molecules. These species have all been observed while trapped in solid argon or neon at temperatures near 4K, i.e., using the matrix-isolation technique. The molecules investigated, and the spectroscopic method employed, are: carbon molecules C4, C5, C6, C9, and their oxides C2O, C3O, in the infrared; rare-earth diatomic and triatomic oxides in the infrared and visible regions; alkaline-earth diatomic fluorides MgF, CaF, SrF, BaF in ESR; diatomic hydrides BeH, MgH, CaH, SrH, BaH, ZnH, CdH, HgH, PdH in ESR. Contributions were also made to the theory of spin-doubling in molecules and to the theory of polytypism in solid silicon carbide. Author (GRA)

N72-18143# Pennsylvania Univ., Philadelphia. Lab. for Research on the Structure of Matter.
[RESEARCH IN MATERIALS SCIENCE AND THE STRUCTURE OF MATTER] Annual Technical Report, 1 Jul. 1970 - 30 Jun. 1971
Eugene R. Nixon 30 Jun. 1971 375 p refs
(Contract DAHC15-67-C-0215)
(AD-733684; ATR-11) Avail: NTIS CSCL 07/4

The research persued at the Laboratory for Research on the Structure of Matter is briefly summaried for each investigation. The topics include the following: Basic chemistry and synthesis; Reaction kinetics and mechanisms; Structure of materials; Thermodynamics and transport properties; Mechanical properties; Phase transformations and defects; Surfaces and thin films; Interfaces and electrodes; Electronic and magnetic properties; Optical and acoustic properties; Quantum mechanics and statistics. GRA

N72-18144# Lincoln Lab., Mass. Inst. of Tech., Lexington.
KINETICONICS AND MOLECULES
Robert N. Davis and James L. Fitzgerald 16 Sep. 1971 11 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-731546; TN-1971-38; ESD-TR-71-268) Avail: NTIS CSCL 07/4

Evolution of the ability to compute molecular models

inevitably leads to exploration of the ways in which models may be converted from computed bits and bytes into readily perceivable mental imagery. Computer-generated dynamic graphic methods may be used to provide enhanced understanding for research, technical reporting, technical explanations, and education.
Author (GRA)

N72-18145# Wayne State Univ., Detroit, Mich.
INVESTIGATION OF THE INTERACTIONS OF IONS AND NEUTRAL ATOMS AND MOLECULES Final Report, 15 Jan. 1970 - 14 Jun. 1971
Pieter K. Rol and Kenneta L. Wendell Aug. 1971 22 p refs
(Contract F19628-70-C-0170)
(AD-734065; AFCRL-71-0443) Avail: NTIS CSCL 07/4

The report reviews some of the earlier results on the reactions of Na with K with atmospheric ions. Improved sensitivity of the merging beams machine made it possible to distinguish between reactions with ground state and excited state reactants. The bond strength of NaO(-) was found. The rate constant for the reaction Mg - O2(-) to MgO - O and for Al - O2(-) to AlO(-) - O was found. The reactions of Mg with NO(-), N2(-) and CO are also discussed. The exothermic reactions proceed via a stripping mechanism, the endothermic reactions via a rebound mechanism. Author (GRA)

N72-18146# Philco-Ford Corp., Newport Beach, Calif. Aeronutronic Div.
INVESTIGATION OF THE ABSORPTION OF INFRARED RADIATION BY NITROUS OXIDE FROM 4000 TO 6700/cm (2.5 TO 1.5 MICROMETERS)
Darrell E. Burch, David A. Gryvnak, and John D. Pembrook Jun. 1971 37 p refs
(Contract F19628-69-C-0263; ARPA Order 1366; AF Proj. 5130)
(AD-734050; U-4943; AFCRL-71-0536; SATR-3) Avail: NTIS CSCL 07/4

All of the N2O bands expected to absorb significantly between 4000 and 6700/cm have been listed, and the strengths of several of the stronger bands have been determined. Spectral curves are shown for samples at low pressure so that the line structure remains and for samples at approximately 15 atm with the structure smoothed out. Author (GRA)

N72-18147# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE 12TH HUNGARIAN CONFERENCE ON EMISSION ANALYSIS
Pal Reti 19 Oct. 1971 8 p Transl. into ENGLISH from Gep (Hungary), v. 22, no. 2, 1970 p 74-75
(AF Proj. 601080)
(AD-734059; FTD-HC-23-1110-71) Avail: NTIS CSCL 07/4

The report very briefly reviews the presentations and events of a conference, jointly sponsored by the materials testing section of the Scientific Association for the Machine Industry, The Association of Hungarian Chemists, and The Hungarian National Association for Mining and Metallurgy, 1969. GRA

N72-18148# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
A FEW PROBLEMS ON ELECTRODE TENSION IN ELECTROCHEMISTRY
Wen-Chih Yang 1 Oct. 1971 54 p refs Transl. into ENGLISH from Hua Hsueh Tung Pao (Peking), no. 7, 1965 p 53-62 and 65
(AD-733924; FTD-HC-23-716-71; AP5020548) Avail: NTIS CSCL 07/4

The author discusses the following: physical significance of electrode tension; meaning of hydrogen scale; selection of plus or minus sign. Measurability of electrode tension and the absoluteness of electrode tension also are discussed along with electrochemical terms and definitions. The purpose of the report is to make use of the information in the CITCE bulletin (Comite International de Thermodynamique et de Cinetique Electrochemiques) and confine it to problems related to balance electric tension. GRA

N72-18149# Pennsylvania Univ., Philadelphia. Electrochemistry Lab.
ELECTROCATALYSIS OF OXYGEN REDUCTION BY THE TUNGSTEN BRONZES Semiannual Report, 1 Sep. 1970 - 30 Apr. 1971
J. McHardy and J. OM. Bockris May 1971 23 p refs
(Contract DA-44-009-AMC-469(T); DA Proj. 1T0-61102A-34-A)
(AD-733941; Rept-7) Avail: NTIS CSCL 07/4

Capacitances measured on tungsten bronze electrodes have provided new information about the electronic properties of the semiconducting surface layer. Both the donor concentration and the flat bond potential are altered by platinum doping. Further evidence has emerged from the work to support the view that the bronze surface undergoes a reversible change in the vicinity of 1.1.3 volts vs. RHE, which may involve the incorporation of oxygen atoms at the more anodic potentials, and their reduction to water at the more cathodic potentials. Author (GRA)

07 COMMUNICATIONS

Includes communications equipment and techniques; noise; radio and communications blackout; modulation telemetry; tracking radar and optical observation; and wave propagation. For basic research see: 23 Physics, General; and 21 Navigation.

N72-18150*+ Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
DESIGN STUDY FOR MULTI-CHANNEL TAPE RECORDER SYSTEM, VOLUME 2
20 Jan. 1972 217 p 2 Vol.
(Contract NAS5-21511)
(NASA-CR-122353; AED-R-3775F-Vol-2) Avail: NTIS CSCL 14C

Skew test data are presented on a tape recorder transport with a double capstan drive for a 100 KHz tone recorded on five tracks simultaneously. Phase detectors were used to measure the skew when the center channel was the 100 KHz reference.
G.G.

N72-18151# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
EDUCATIONAL TELEVISION VIA SATELLITE. PRELIMINARY STUDIES AND PLANS, VOLUME 1 [TELEVISION EDUCATIVA VIA SATELITE. ESTUDIOS DE ANTECEDENTES Y PROYECTO PRELIMINAR DE PLAN, TOMO 1]
1970 85 p refs In SPANISH
Avail: NTIS

A general review of the use of educational television via satellite is presented. The problems associated with such systems are discussed, as well as the advantages and disadvantages of various types of systems. Previous research and projects involving educational satellite television are considered.
Transl. by K.P.D.

N72-18152# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
EDUCATIONAL TELEVISION VIA SATELLITE. PRELIMINARY STUDIES AND PLANS, VOLUME 2 [TELEVISION EDUCATIVA VIA SATELITE. ESTUDIOS DE ANTECEDENTES Y PROYECTO PRELIMINAR DE PLAN, TOMO 2]
1970 85 p In SPANISH
Avail: NTIS

A preliminary design for a national and regional education system utilizing satellite television is considered for Argentina and other South American countries, taking special zonal factors into account. International aspects of educational TV and legal precedents are considered. Population distribution and educational statistics are also presented. Transl. by K.P.D.

N72-18153*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
THE DEEP SPACE NETWORK, VOLUME 7 Progress Report, Nov. - Dec. 1971
15 Feb. 1972 228 p refs
(Contract NAS7-100)
(JPL-TR-32-1526-Vol-7) Avail: NTIS CSCL 22A

The objectives, functions, and organization of the Deep Space Network are summarized. The Deep Space Instrumentation Facility, the Ground Communications Facility, and the Space Flight Operations Facility are described. Author

N72-18154*# Radio Corp. of America, Camden, N.J. Government Communications Systems.
MULTI-INTEGRATOR DELTA MODEL Final Report
10 Dec. 1971 4 p
(Contract NAS9-11901)
(NASA-CR-115391) Avail: NTIS CSCL 17B

A compilation of improvements and test results is presented. The LPF preceding the VOGAD preamplifier on the M1 board was tested in regard to its rejection of possible timing noise resulting from operating at the lowest standard rate of 9.6 KHz. The dynamic range of the VOGAD preamplifier, also on board M1 was extended to a full 30 d while introducing a distortion of less than 5% into the audio signal being processed. Author

N72-18155# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
METHODS AND MEASURING INSTRUMENTS FOR DETERMINING THE WORKING CONDITIONS IN A PHASE MODULATED TRANSMITTING SYSTEM
Giorgio Ravelli Dec. 1970 59 p refs In ITALIAN; ENGLISH summary
(Rept-34) Avail: NTIS

Several methods are described which can be used to measure the modulation characteristics of transmission systems employing low deviation phase-modulated carriers during the design and testing of such systems. Fourier analysis was applied to carriers which were phase-modulated by the more common information signals in order to obtain the power distribution over the frequency spectrum. The working principles and essential characteristics of the instruments that can be used in the present application are given. The procedures employed in using such instruments are discussed, based on the given mathematical expressions. Graphs are presented for a simpler application of the proposed methods. Author

N72-18156# Academy of Sciences (USSR), Moscow.
USE OF A SINGLE-CHANNEL CORRELATOR TO FIND A SYNCHRONIZATION FRAME FOR UNIFIED TELEMETRY SYSTEMS
V. V. Lavrusevich 1971 16 p refs In RUSSIAN
(D-109) Avail: NTIS

The structure of a synchronization frame is considered, based on a single-channel correlator, the realization of which demands a much smaller amount of instrumentation in comparison with classic multichannel correlators, and whose detection time depends on the time of satellite observation. A variant construction plan for extracting telemetric information at ground stations is presented. Transl. by K.P.D.

N72-18157*# Magnavox Co., Fort Wayne, Ind.
SPREAD SPECTRUM COMMUNICATION LINK USING SURFACE WAVE DEVICES Final Report, Dec. 1970 - Nov. 1971
Bill J. Hunsinger and Brian B. Fugit Nov. 1971 143 p
(Contract NAS5-20198)
(NASA-CR-122344; ASW-354) Avail: NTIS CSCL 17B

A fast lock-up, 8-MHz bandwidth 8,000 bit per second data rate spread spectrum communication link breadboard is described that is implemented using surface wave devices as the primary signal generators and signal processing elements. It uses surface wave tapped delay lines in the transmitter to generate the signals and in the receiver to detect them. The breadboard provides a measured processing gain for Gaussian noise of 31.5 dB which is within one dB of the theoretical optimum. This development demonstrates that spread spectrum receivers implemented with surface wave devices have sensitivities and complexities comparable to those of serial correlation receivers, but synchronization search times which are two to three orders of magnitude smaller. Author

N72-18158# Lockheed Missiles and Space Co., Palo Alto, Calif.
AIRCRAFT AND MISSILE RADAR UNITS UTILIZED TO COMBAT AN AIRBORNE ENEMY
V. V. Grigorin-Riabov, ed. [1971] 25 p refs Transl. into ENGLISH from the book "Radiolokatsionnye Ustroistva (Teoriia i Printsipy Postroeniia)" Moscow, Sovetskoe Radio Press, 1970 p 555-590
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The whole complex of equipment intended especially to annihilate airborne means of attacking the enemy is part of the aircraft interception system. On-board radar units of the interception system, mounted on fighters and guided missiles of the air-to-air class, as well as radar means of the system to protect the aircraft are examined. The required detection range, measurement accuracy, and other radar characteristics depend essentially on the tactical and technical characteristics of the aircraft on which the equipment is installed, and of the other facilities taking part in solving the given problem, hence tactical-technical demands are fundamental. Author

N72-18159*# Bellcomm, Inc., Washington, D.C.
A MODEL FOR CALCULATING EXPECTED PERFORMANCE OF THE APOLLO UNIFIED S-BAND (USB) COMMUNICATION SYSTEM
N. W. Schroeder 30 Dec. 1971 50 p refs
(Contract NASw-417)
(NASA-CR-125670; TM-71-2034-3) Avail: NTIS CSCL 17B

A model for calculating the expected performance of the Apollo unified S-band (USB) communication system is presented. The general organization of the Apollo USB is described. The mathematical model is reviewed and the computer program for implementation of the calculations is included. Author

N72-18160*# Radio Corp. of America, Princeton, N.J. Astro-Electronics Div.
DESIGN STUDY FOR MULTI-CHANNEL TAPE RECORDER SYSTEM, VOLUME 1 Design Study Report, 4 Sep. 1970 - 31 May 1971
20 Jan. 1972 178 p 2 Vol.
(Contract NAS5-21511)
(NASA-CR-122352; AED-R-3775F-Vol-1) Avail: NTIS CSCL 14C

The means of storing multispectral, high resolution sensor data on an Earth observing satellite are studied. It is concluded that this is best done digitally on a multi-track, longitudinal, magnetic tape recorder. The machine proposed will store 8 X 10 to the 10th power bits of data on 1040 m of 51 mm-wide magnetic tape mounted on two co-planar reels. Author

N72-18161*# Texas Instruments, Inc., Dallas. Semiconductor Circuits Div.
ANALOG TREE-ORGANIZED MULTIPLEXER Quarterly Technical Report

J. S. Crabbe, D. M. Smith, and W. R. Turner 5 Nov. 1971 64 p refs Prepared for JPL
(Contracts NAS7-100; JPL-953117)
(NASA-CR-125636; TI-03-71-95; QTR-1) Avail: NTIS CSCL 09F

An analog tree-organized multiplexer (ATOM) which is intended for use in the telemetry system of an interplanetary spacecraft is designed. The ATOM will be fabricated by a monolithic, dielectric isolation process, and will contain silicon junction field effect transistors (JFET) as the active elements. The effect of the radiation environment on the performance of the ATOM is analyzed. The result indicates that the expected radiation environment will cause only minor changes in the preradiation characteristics of ATOM. The JFET in the ATOM is designed to meet the electrical requirements when fabricated by either the double poly-dielectric isolation process or the raised dielectric isolation process. The effect of the heat treatment required for the dielectric isolation process on the diffusion profile of the JFET is described. The layout of the ATOM circuit for fabrication by either the double poly or raised dielectric isolation process is also given. Author

N72-18162*# Illinois Univ., Urbana. Dept. of Geography.
RADAR AS A TOOL FOR REGIONAL INVESTIGATIONS
Nelson R. Nunnally Feb. 1969 30 p refs Prepared in cooperation with Geol. Surv.
(NASA Order R-09-020-024)
(NASA-CR-125634; USGS-IR-NASA-67) Avail: NTIS CSCL 17I

Radar is considered as a means for delimiting associations of physical and cultural phenomena by outlining image variation in tone, texture, pattern, and shape. Classification and description of landscape types are discussed. The imagery used for the study covers a portion of the Asheville Basin in North Carolina, extending from Hot Springs to an area southeast of Hendersonville. Eleven regions are discussed. K.P.D.

N72-18163# Israel Program for Scientific Translations, Ltd., Jerusalem.
THE EFFECTS OF THE TURBULENT ATMOSPHERE ON WAVE PROPAGATION
V. I. Tatarskii 1971 482 p refs Transl. into ENGLISH of the book "Rasprostranenie Voln v Turbulentnoi Atomosfere" Moscow, Nauka Press, 1967 Sponsored by NOAA, Dept. of Commerce, and NSF
(TT-68-50464) Avail: NTIS HC $6.00/MF $0.95

Atmospheric turbulence produces fluctuations in the parameters of propagating waves and constitutes a significant source of errors and distortions in communications and control systems. In other instances, turbulence acts as a source of inhomogeneities which scatter radio waves. Both theoretical and experimental work concerning the effects of atmospheric turbulence on radio and sound wave propagations are presented. The statistical theory of turbulence provides a quantitative treatment of the various phenomena. Some field fluctuations are treated by mathematical methods derived from quantum field theory, i.e., the Feynman diagrams and the variational equations. Considerable emphasis is placed on strong fluctuations of the wave amplitude. Author

N72-18164# Joint Publications Research Service, Arlington, Va.
ANALYSIS OF THRESHOLD CHARACTERISTICS OF THE SYNCHRONOUS-PHASE DEMODULATOR
Ye. G. Okhtyarkan and V. V. Loginov 28 Feb. 1972 8 p refs Transl. into ENGLISH from Elektrosvyaz (Moscow), no. 12, 1970 p 8-11
(JPRS-55281) Avail: NTIS

The determination of the threshold properties of the SPD (synchronous phase demodulator), the threshold signal/noise ratio for optimal transfer function, and for the system of the second order was found on the basis of the criterion for the minimum dispersion of phase error. The SPD was examined both with and without filters. Comparison of the threshold points of the SPD without a filter and with a proportional integrating filter indicates that use of the filter permits increasing essentially the gain in the displacement of the threshold with large modulation indexes. E.H.W.

N72-18165# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
METHOD OF EDGE WAVES IN THE PHYSICAL THEORY OF DIFFRACTION
P. Ya. Ufimtsev 7 Sep. 1971 242 p refs Transl. into ENGLISH of the book "Metod Kraevykh Voln v Fizicheskoi Teoroii Difraktsii" Izd-vo Sovetskoye Radio, 1962 p 1-243
(AF Proj. 5546)
(AD-733203; FTD-HC-23-259-71) Avail: NTIS CSCL 20/14

The diffraction of plane electromagnetic waves by ideally conducting bodies, the surface of which have discontinuities, is investigated in the report. The linear dimensions of the bodies are assumed to be large in comparison with the wavelength. The method developed takes into account the perturbation of the field in the vicinity of the surface discontinuity and allows one to substantially refine the approximations of geometric and physical optics. Expressions are found for the fringing field in the distant zone. A numerical calculation is performed of the scattering characteristics, and a comparison is made with the results of rigorous theory and with experiments. Author (GRA)

N72-18166# Naval Research Lab., Washington, D.C.
AN AUTO TRACKING ANTENNA SYSTEM Final Report
George E. Price 7 Oct. 1971 38 p refs
(NRL Proj. R06-29)
(AD-732380; NRL-7318) Avail: NTIS CSCL 09/5

A systematic approach has been made to the design of a digital auto-tracking antenna system. When such a system is converted from a manual tracking system, the main design criteria of accuracy, reliability, ease of maintenance, and minimum cost are advanced by designing the new system around one of the present modes of operation. An optimum technique to convert from a manual tracking antenna system to an auto-tracking antenna system is made possible by the commercial availability of low-cost and accurate digital-to-synchro (D/S) converters and the development of a special-purpose system controller, the automatic control unit ACU-1. The auto-tracking system is designed to relieve the system operator of menial tasks while taking maximum advantage of his ability to make decisions. Author (GRA)

N72-18167# Naval Ship Research and Development Center, Bethesda, Md. Computer Sciences Div.
SLOPE-INTENSITY DETECTION SYSTEM FOR SPEECH RECOGNITION
S. Berkowitz Aug. 1971 18 p
(SF Proj. 14-532-107; NSRDC Proj. 830-918)
(AD-732753; NSRDC-3731) Avail: NTIS CSCL 17/2

The report describes the design and operation of a class of speech recognition devices which extract slope and intensity information from a short-term spectral analysis of a spoken word (one of a fixed but arbitrary vocabulary), and determine which vocabulary word has been spoken, by means of programmable decision logic using the thresholded slope intensity parameters just mentioned as inputs. Author (GRA)

N72-18168# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF TARGET ENHANCEMENT USING COLORED BACKGROUNDS ON A SIMULATED RADAR DISPLAY M.S. Thesis
William James Wallace, Jr. Sep. 1971 56 p refs
(AD-733182) Avail: NTIS CSCL 17/9

The study investigated the hypothesis that sequential changes of background color on a simulated radar display enhances target detectability. Two experiments were conducted wherein target detectability was assessed in terms of the accuracy in which subjects determined the presence of a randomly appearing target symbol imbedded in visual noise. The first experiment tested 30 subjects to determine the relative detectability of targets among display backgrounds of homogeneous color and backgrounds presenting abrupt changes of color. The second experiment tested 24 subjects to determine if the speed and/or sequence of background color change affected target detectability. Results of the study showed that homogeneous green or blue backgrounds significantly enhanced target detectability when compared to the sequentially changing colored background, and that speed and sequence of background color change have little effect. The study also showed colored backgrounds to enhance target detectability when compared to the conventional method of radar display. Author (GRA)

N72-18169# Ballistic Research Labs., Aberdeen Proving Ground, Md.
PROJECTILE HIGH-G TELEMETRY FOR LONG RANGE DYNAMICS MEASUREMENT
William H. Mermagen Oct. 1971 39 p refs
(RDT/E Proj. 1-t-061102-a-33-d)
(AD-733305; BRL-MR-2133) Avail: NTIS CSCL 09/6

Devices to measure the pitching, yawing, and rolling motion of a projectile from on board and telemeter the measurements to ground receiving stations have been developed. Two of these devices, a solar aspect sensor and an accelerometer, are described in detail. The complete telemetry system with g-hardening to survive gun-launch accelerations is described and techniques for high-g are discussed. The results of several recent flight tests of these yawsondes are presented and show the unique usefulness of the instruments for measuring dynamical behavior of projectiles over their entire flight paths.
Author (GRA)

N72-18170# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
A DETERMINATION OF THE OPTIUM MODULATION TECHNIQUE FOR MOBILE AND MANPACKED MILITARY RADIO SETS M.S. Thesis
James E. Malmberg 1970 116 p refs
(AD-733381) Avail: NTIS CSCL 17/2

The specific question which the study has attempted to answer is -- is it possible to improve the performance of single channel tactical radio communications by utilizing modulation techniques different from those presently employed. The answer is yes, it is possible. The development of a practical vocoder system with bit rates of 6000 bits per second, or less, with reasonable intelligibility, will provide a system which exhibits spectrum utilization at least three times as efficient as FM and is superior to FM as regards signal to noise ratio. The study also shows that such a vocoder system would be a frequency modulated digital system and would possess the advantages of immunity to interference and nuisance jamming to a slightly greater degree than FM. This would minimize the need for operator training. Author (GRA)

N72-18171# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
PENNSYLVANIA-PRINCETON ARMY AVIONICS RESEARCH PROGRAM. ACOUSTIC NOISE ENVIRONMENT. IMPROVEMENT OF SPEECH INTELLIGIBILITY IN A HIGH NOISE ENVIRONMENT Final Report
Fred Haber Nov. 1971 15 p refs
(Contract DA-28-043-AMC-02411(E); DA Proj. 1H1-62202-A-219)
(AD-733431; Rept-72-06; ECOM-02411-23) Avail: NTIS CSCL 17/2

A study was made to determine methods of improving intelligibility of voice transmissions which are in a high acoustic noise environment such as exists inside helicopters operating under technical conditions. The report summarizes three areas of study and a tested technique using multiple microphones for increasing voice intelligibility. Author (GRA)

N72-18172# Cayuga Associates, Inc., Ithaca, N.Y.
C AND X-BAND LSA TRANSMITTER SOURCE Final Report, 1 Jun. 1970 - 31 May 1971
Joseph S. Bravman, David W. Woodard, and Lester F. Eastman Nov. 1971 37 p refs
(Contract DAAB07-70-C-0224; DA Proj. 1H6-62705-a-056)
(AD-733425; ECOM-0224-F) Avail: NTIS CSCL 09/1

Layers of uniform GaAs were epitaxially grown, from a Ga-solution, with thicknesses up to 250 micrometers and electron concentration from 1.0 to 2.0 x 10 to the 15th power/cu cm. Peak to valley current ratios up to 2.25:1 were measured. Circuit parameters including optimum load resistance were studied and results are presented. An improvement in oscillator efficiency by a factor of 1.5 resulted from resonating the second harmonic in some devices. Two types of microwave resonators were used and both incorporated 1/4 wavelength transformers with inherent preferential loading of the fundamental frequency. Mechanical and electronic tuning were also studied. The degradation of efficiency when increased average power was dissipated was measured and explained. Pulse modulators were also investigated. The SCR switched lumped line type modulator appeared best for use with very high power LSA sources. Sample pulsers were able to deliver over 550 volts into a 50 ohm load. The lumped line (PFN) could be optimized to provide a good sin x/x type spectrum. Author (GRA)

N72-18173# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE UTES MULTIPURPOSE RADAR COMPLEX
V. Kulikov 24 Aug. 1971 12 p Transl. into ENGLISH from Grazhdanskaya Aviatsiya (USSR), v. 28, no. 1, 1971 p 32-33
(FTD Proj. 7R4)
(AD-733273; FTD-HT-23-952-71) Avail: NTIS CSCL 17/9

The article briefly describes the UTES radar complex, intended for multipurpose use in civilian air-traffic control (height 20 m, parabolic reflector grid (18 x 10.5 m) range 450 km at high altitudes). The physical layout of the equipment room is described as well as several features giving UTES a decided advantage over similar foreign models. Author (GRA)

N72-18174# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.
IMAGE QUALITY IN SAMPLED DATA SYSTEMS
Lucien Biberman, M., Richard Legault, A. Fenner Milton, Frederick A. Rosell, Otto H. Schade, Alvin D. Schnitzler, and Harry L. Snyder Aug. 1971 228 p refs
(Contract DAHC15-67-C-0011)
(AD-733663; P-741; IDA/HQ-71-13139) Avail: NTIS CSCL 09/1

The paper deals with aliasing, an important effect of one-and two-dimensional sampling on image quality. Aliasing changes the normal criteria of utility of the modulation transfer function (MTF) as a measure of system quality. Aliasing can be eliminated by letting the MTF fall to zero at one-half the sampling frequency. This, of course, markedly reduces the signal-to-noise ratio at the display (SNR(D)) near cutoff and thus reduces operator performance. Several factors control the amount of information an observer extracts from an image and the rate at which he extracts it. The paper presents the results of a series of experimental programs relating observer performance to the modulation transfer function area (MTFA) and to the SNR(D) and derives the relationship between MTFA and SNR(D). The paper discusses the tradeoffs as they are presently understood.
Author (GRA)

N72-18175# Duke Univ., Durham, N.C.
ON THE ELECTROMAGNETIC FIELD RADIATED ABOVE THE TREETOPS BY AN ANTENNA LOCATED IN A FOREST Research and Development Technical Report
T. Tamir (Polytechnic Inst. of Brooklyn) Jun. 1971 30 p refs
(Contract DA-31-124-ARO(D)-399; DA Proj. 1H6-62701-A-350)
(AD-733288; ECOM-3443) Avail: NTIS CSCL 20/14

Theoretical investigations of the field in forest environments have usually considered the case where both the transmitting antenna and the receiving terminal were located within or very close to the vegetation. The present work examines the case where one of the two antennas is located inside the forest while the other is situated above the tree tops. The mechanism of wave propagation and its effect on the field variation are discussed for heights that start at the forest-air interface and extend vertically to large elevations. It is shown that the field just above that interface and up to a critical height H sub c is dominated by a lateral wave. Above the height H sub c, the field is given by a refracted line of sight wave whose amplitude is subject to a strong height gain effect. This gain continues up to a height H sub m above which the field starts decreasing monotonically. Both vertical and horizontal polarizations are examined and typical results are given for several representative forest varieties. While the present results extend certain conclusions obtained from previous work, they also represent an important first step in solving communication problems involving mixed paths which cross partly through vegetation and partly through air or clearings. Author (GRA)

N72-18176# Weather Wing (2nd), APO 332, New York.

UNDERSTANDING AND USING FPS-77 RADAR DATA

Charles Melson 1 Nov. 1971 23 p
(AD-733429; Rept-2WW-TN-71-1) Avail: NTIS CSCL 17/9

The note discusses the AN/FPS-77 weather radar, its scopes, controls, and the radar operating procedures used at Hahn AB, Germany. The RAMET code is considered as well as the use of scope photography. The purpose of the note is to inform using agencies of the uses and limitations of the information received from a radar station. Author (GRA)

N72-18177# Polytechnic Inst. of Brooklyn, Farmingdale, N.Y.

NARROW BAND SYSTEMS AND GAUSSIANITY

A. Papoulis Griffiss AFB, N. Y. RADC Nov. 1971 36 p refs
(Contract F30602-69-C-0331)
(AD-733739; RADC-TR-71-225) Avail: NTIS CSCL 09/4

The approach to Gaussianity of the output y(t) of a narrowband system h(t) is investigated. It is assumed that the input x(t) is an a-dependent process in the sense that the random variables x(t) and x(t-u) are independent for u = a. With F(y) and G(y) the distribution function of y(t) and of a suitable normal process, a realistic bound B of the difference F(y) G(y) is determined and it is shown that B approaches 0 as the bandwidth omega sub 0 of the system tends to zero. Author (GRA)

N72-18178# Little (Arthur D.), Inc., Cambridge, Mass.

REPLACEMENT OF MICROWAVE RADIOS IN THE DEFENSE COMMUNICATIONS SYSTEM Final Report

Harvey L. Pastan Nov. 1971 8 p
(Contract N00014-71-C-0038)
(AD-733713; ADL-C-72754) Avail: NTIS CSCL 17/2

Microwave communication systems, Specifications, Radio equipment, Cost effectiveness, Department of Defense Reevaluation of microwave radio specification, DCSS 1-70 A, in terms of cost effectiveness and ability to support hybrid (digital and analog) base band signals is discussed. Author (GRA)

N72-18179# Lincoln Lab., Mass. Inst. of Tech., Lexington.

TOPICS IN MILLIMETER-WAVE AND OPTICAL SPACE COMMUNICATION

William W. Ward and Stephen L. Zolnay 16 Sep. 1971 34 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-731535; TN-1971-43; ESD-TR-71-269) Avail: NTIS CSCL 17/2

Many comparative studies have been made of millimeter-wave and optical space-communication systems. The applications considered have been diverse, including links between satellites in low Earth orbits, satellites in synchronous orbits, deep-space probes, and Earth terminals, with data-rate requirements from a few bit/sec to Gbit/sec. This report presents a short tutorial account of the common and of the distinctly different features of some millimeter-wave and optical space-communication systems. For example, the design of the transmitting antennas is governed by the same electromagnetic theory, which accounts for diffraction at an aperture. However, the signal-to-noise relationships in the receivers may not be the same (Gaussian vs Poisson noise statistics). Possible satellite applications are surveyed briefly, with mention of the favorable and the unfavorable factors associated with millimeter-wave and optical space-communication systems. Candidate systems are postulated and link calculations are given. Author (GRA)

N72-18180# Leach Corp., Azusa, Calif. Controls Div.

AIR TRAFFIC CONTROL VOICE RECORDER DEVELOPMENT Final Technical Report, 30 Jun. 1970 - 30 Jun. 1971

John T. Sapp, Richard E. Crowe, and Eugene M. Farole Sep. 1971 253 p refs
(Contract F30602-70-C-0297)
(AD-731562; Rept-203296A; RADC-TR-71-181) Avail: NTIS CSCL 14/3

The report summarizes the results of the Phase I study portion of a two-phase program designed to establish the technical base for development of two new, standard, multichannel voice recorder-reproducer sets. These sets are intended for use in recording the radio and landline communications at fixed and mobile Air Traffic Control (ATC) facilities. The basic problem is to provide a technically feasible, cost effective means of recording 80 channels of voice data on a single reel of magnetic tape for a period of 25 hours. The choice of head track geometry and multiplexing techniques emerge as the most critical factors affecting the design concept. A study of multiplexing techniques as affected by tape transport anomalies and signal conditioning characteristics is conducted in depth. Tape drive electronics are analyzed for performance at low speeds to optimize the recording time available for a given tape length. As a result of the Phase I study, the conclusion is that a record/reproduce tape speed of 1.2 inches per second should be utilized to record three (3) channels of the input voice data on each track of a 28-track head/tape configuration, using a double sideband multiplexing technique. Author (GRA)

N72-18181# Lincoln Lab., Mass. Inst. of Tech., Lexington.

CLUTTER RETURN FROM VEGETATED AREAS

Shalom Rosenbaum and Leonard W. Bowles 10 Sep. 1971 80 p refs
(Contract F19628-70-C-0230; ARPA Order 1559; AF Proj. 649L)
(AD-731545; TN-1971-34; ESD-TR-71-138) Avail: NTIS CSCL 17/9

The objective of the report is the presentation of an analytical-stochastic model capable of predicting relevant statistical scattering features of electromagnetic waves propagating within vegetated environments. The propagation phenomena are described by formulating the scattering associated with ramdom permittivity fluctuations superimposed on a lossy deterministic background slab. The mean backscattered power, its variance and one-point distribution are calculated. The spectral characteristics of clutter from windblown foliage are investigated using two models: one presuming the velocity field to constitute a multivariate normal process and another presuming the scatterer's motion to be quasi-harmonic over limited time segments. Author (GRA)

N72-18182# Naval Electronics Lab. Center for Command Control and Communications, San Diego, Calif.

FEEDBACK COMMUNICATION ON DUPLEX DIGITAL LINKS Research and Development Report, Jul. 1968 - Jun. 1971

C Nuese 28 Sep. 1971 56 p refs
(Proj. ZFXX.212.001(NELC-Z222))
(AD-733967; NELC-TR-1775) Avail: NTIS CSCL 09/4

The report considers the conditions under which feedback can be used effectively in two-way digital communication systems. It recommends the use of feedback whenever a return link is available and the need for reliability, efficiency, and accuracy justifies the cost in complexity in equipment and procedures. It outlines procedures for using a combination of forward error detection and correction codes and automatic feedback of repeat requests when residual errors are detected to obtain effective and efficient error control. Author (GRA)

N72-18183# Army Electronics Command, Fort Monmouth, N.J.
LOSSY MEDIA PROPAGATION AT 50 kHz
Kenneth Murphy and Kurt Ikrath Jul. 1971 18 p ref
(DA Proj. 1H6-62701-A-44806)
(AD-733902; ECOM-3458) Avail: NTIS CSCL 09/5

Experiments were conducted using a magnetic sheet antenna immersed in sea water at 50 kHz. The decay of a transmitted signal as a function of distance from antenna was measured above and below the water surface using a ferrite receiving probe. The radiation pattern of the transmitting antenna in water are also presented. Author (GRA)

N72-18248# Academy of Sciences (USSR), Moscow.
STRUCTURAL FEATURES AND BASIC PARAMETERS OF THE LUNOKHOD 1 TELEVISION SYSTEMS
A. S. Selivanov, V. M. Govorov, V. V. Zasetskiy, and V. A. Timokhin *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 55-64 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

08 COMPUTERS

Includes computer operation and programming; and data processing. For applications, see specific categories. For related information see also: 19 Mathematics.

N72-18184* Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena.
MODULAR ENCODER Patent
Tage O. Anderson, inventor (to NASA) Issued 7 Sep. 1971 8 p Filed 24 Sep. 1969 Supersedes N70-35676 (08 - 12, p 2181) Sponsored by NASA
(NASA-Case-NPO-10629; US-Patent-3,603,976; US-Patent-Appl-SN-860751; US-Patent-Class-340-347DD; US-Patent-Class-178-66; US-Patent-Class-179-15; US-Patent-Class-235-154; US-Patent-Class-178-50) Avail: US Patent Office CSCL 09B

A biorthogonal encoder of modular design is described, in which each module operates in a serial or cyclic mode. The number of modules M is equal to N/2 if N, the number of bits of the data word, is even, or to (N+1)2 if N is odd. Each module includes a two-bit shift register, a storage bit and a mod two gate. The input to the register's is a mod two function of the register's output and that of the storage bit. The outputs of all the M modules are added mod two to provide the 2 to the Nth power bits of each code word in sequence.
Offical Gazette of the U.S. Patent Office

N72-18185# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziole.
DEFINITION AND ESTIMATION OF THE ERRORS IN THE SPECTRAL ANALYSIS OF LOCALLY STATIONARY RANDOM DATA
Roberto Ferroni and Guido Morelli May 1971 31 p refs In ITALIAN; ENGLISH summary
(Rept-37) Avail: NTIS

The errors in measuring the power spectral density of a locally stationary random process are discussed. A mathematical expression of the statistical error was obtained and an experimental procedure for its exact evaluation established. A rough estimation of the maximum error associated with the peak value of the power spectral density is given. Author

N72-18186# Ohio State Univ., Columbus. Computer and Information Science Research Center.
SPEECH SYNTHESIS BY HAAR FUNCTIONS WITH COMPARISON TO A TERMINAL ANALOG DEVICE Ph.D. Thesis
David Meltzer Jan. 1972 143 p refs
(Grant NSF GN-534-1; RF Proj. 2218)
(OSU-CISRC-TR-72-2) Avail: NTIS

The feasibility of using the Haar system of functions as the basis of a method of generating speech is investigated. This involves an estimate of the maximum amount of information necessary to generate intelligible speech and a determination of the type and amount of computer processing necessary. The methodology used to determine the answers is to analyze sampled natural speech productions in terms of Haar spectra on a computer and then to synthesize the words using the information gained from the analysis. This method corresponds to simulating a Haar based channel vocoder on the computer. The emphases are the general characteristics of the spectra for different phonemes and words taken from natural productions and the methods of quantizing the spectra in order to obtain high intelligibility in the synthesized output but retain the smallest amount of information. All of the processing and synthesis was done on a general purpose computer and the output fed to a DAC. It is concluded that the Haar transform speech synthesis is feasible and affords at least a 5 to 1 reduction in data rates over sampled speech. Author

N72-18187# Ohio State Univ., Columbus. Computer and Information Science Research Center.
STIMULUS ENCODING AND HUMAN INFORMATION PROCESSING M.S. Thesis
John Donald Williams Nov. 1971 71 p refs
(Grant NSF GN-534-1)
(OSU-CISRC-TR-71-11) Avail: NTIS

The present experiment was designed to test the hypothesis that the subject (S) is an efficient encoder of information in a choice reaction time task using a one-to-one mapping between stimulus and response. Four binary stimulus dimensions made it possible to generate 16 stimuli. The experiment was conducted using two sets containing arrangements of two, four, and eight stimuli from the total of 16 that were possible. In the first set, identified as the minimum relevant dimensions condition, it was necessary for S to encode one, two, or three stimulus dimensions in the subgroups of two, four, and eight stimuli respectively in order to efficiently accomplish accurate stimulus identification. In the second set, called the maximum relevant dimensions condition, S was required to encode one, three, or four stimulus dimensions to efficiently accomplish accurate stimulus classification. Author

N72-18188# Ohio State Univ., Columbus. Computer and Information Science Research Center.
A MODIFICATION OF A METHOD OF GENERATING RANDOM NUMBERS USING A COMBINATION OF TWO CONGRUENTIAL GENERATORS M.S. Thesis
Sue Anne Sanders Dec. 1971 80 p refs
(Grant NSF GN-534-1; RF Proj. 2218)
(OSU-CISRC-TR-71-12) Avail: NTIS

A heuristic justification of the modified MacLaren and Marsaglia method of generating random numbers is given. Formulas have been developed which yield, under ideal conditions, the probability that a consecutive set of r + 1 random numbers in the sequence produced by the primary generator remains a consectutive set of r + 1 ramdom numbers in the new sequence. These probabilities were calculated for a table of length 2. The probabilities decrease with r and are not large even for this table length; all are less than one half. Author

N72-18189*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTERIZED MULTILEVEL ANALYSIS FOR MULTILAYERED FIBER COMPOSITES

Christos C. Chamis 1972 26 p refs Presented at Natl. Symp. on Computerized Structural Analysis and Design, Washington, D. C., 27-29 Mar. 1972

(NASA-TM-X-68006; E-5611) Avail: NTIS CSCL 09B

A FORTRAN 4 computer code for the micromechanics, macromechanics, and laminate analysis of multilayered fiber composite structural components is described. The code can be used either individually or as a subroutine within a complex structural analysis/synthesis program. The inputs to the code are constituent materials properties, composite geometry, and loading conditions. The outputs are various properties for ply and composite; composite structural response, including bending-stretching coupling; and composite stress analysis, including comparisons with failure criteria for combined stress. The code was used successfully in the analysis and structural synthesis of flat panels, in the buckling analysis of flat panels, in multilayered composite material failure studies, and lamination residual stresses analysis. Author

N72-18190*# Maryland Univ., College Park. Computer Science Center.

ON A PROGRAMMING LANGUAGE FOR GRAPH ALGORITHMS

Werner C. Rheinboldt, Victor R. Basili, and Charles K. Mesztenyi Jun. 1971 44 p refs

(Grants NGL-21-002-008; NSF GJ-1067)

(NASA-CR-125597; TR-158) Avail: NTIS CSCL 09B

An algorithmic language, GRAAL, is presented for describing and implementing graph algorithms of the type primarily arising in applications. The language is based on a set algebraic model of graph theory which defines the graph structure in terms of morphisms between certain set algebraic structures over the node set and arc set. GRAAL is modular in the sense that the user specifies which of these mappings are available with any graph. This allows flexibility in the selection of the storage representation for different graph structures. In line with its set theoretic foundation, the language introduces sets as a basic data type and provides for the efficient execution of all set and graph operators. At present, GRAAL is defined as an extension of ALGOL 60 (revised) and its formal description is given as a supplement to the syntactic and semantic definition of ALGOL. Several typical graph algorithms are written in GRAAL to illustrate various features of the language and to show its applicability. Author

N72-18191*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

NAMER: A FORTRAN 4 PROGRAM FOR USE IN OPTIMIZING DESIGNS OF TWO-LEVEL FACTORIAL EXPERIMENTS GIVEN PARTIAL PRIOR INFORMATION

Steven M. Sidik Washington Mar. 1972 68 p refs

(NASA-TN-D-6545; E-6329) Avail: NTIS CSCL 09B

Under certain specified conditions, the Bayes procedure for designing two-level fractional factorial experiments is that which maximizes the expected utility over all possible choices of parameter-estimator matchings, physical-design variable matchings, defining parameter groups, and sequences of telescoping groups. NAMER computes the utility of all possible matchings of physical variables to design variables and parameters to estimators for a specified choice of defining parameter group or groups. The matching yielding the maximum expected utility is indicated, and detailed information is provided about the optimal matchings and utilities. Complete documentation is given; and an example illustrates input, output, and usage. Author

N72-18192*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.

UNIFORM RANDOM NUMBER GENERATORS

William R. Farr 10 Nov. 1971 15 p refs

(NASA-TM-X-64637) Avail: NTIS CSCL 09B

Methods are presented for the generation of random numbers with uniform and normal distributions. Subprogram listings of Fortran generators for the Univac 1108, SDS 930, and CDC 3200 digital computers are also included. The generators are of the mixed multiplicative type, and the mathematical method employed is that of Marsaglia and Bray. Author

N72-18193*# Axiomatix, Marina del Rey, Calif.

A PARAMETRIC STUDY OF THE COMPLEXITY OF SEQUENTIAL DECODERS, VOLUME 1 Final Report

Gaylord K. Huth 27 Jan. 1972 65 p 2 Vol.

(Contract NAS9-12091)

(NASA-CR-115401; R7201-1-Vol-1) Avail: NTIS CSCL 09B

The complexity and performance of practical sequential decoders were studied. Upon comparing sequential decoders with Viterbi decoders, it was found that sequential decoders outperform Viterbi decoders at low data rates (19.2 to 76.8 kbps) for the same complexity. However, Viterbi decoders are less complex than sequential decoders at high data rates (9.1 Mbps) for the same performance. Author

N72-18194*# Axiomatix, Marina del Rey, Calif.

A PARAMETRIC STUDY OF THE COMPLEXITY OF SEQUENTIAL DECODERS, VOLUME 2 Final Report

Gaylord K. Huth 27 Jan. 1972 93 p refs 2 Vol.

(Contract NAS9-12091)

(NASA-CR-115402; R7201-1-Vol-2) Avail: NTIS CSCL 09B

Plots are presented of complexity versus required signal energy per bit/single-sided noise spectral density to obtain an output probability of error per bit of 0.0001 for an ideal coherent PSK demodulation. Transfer function of convolutional codes and techniques of branch and reference phase synchronization are considered. Author

N72-18195*# South Dakota State Univ., Brookings. Remote Sensing Inst.

PATTERN RECOGNITION SYSTEMS AND PROCEDURES Annual Report

Gerald D. Nelson and David V. Serreyn Feb. 1972 23 p refs

(Grant NGL-42-003-007)

(RSI-72-03; NASA-CR-125668) Avail: NTIS CSCL 05B

The objectives of the pattern recognition tasks are to develop (1) a man-machine interactive data processing system; and (2) procedures to determine effective features as a function of time for crops and soils. The signal analysis and dissemination equipment, SADE, is being developed as a man-machine interactive data processing system. SADE will provide imagery and multi-channel analog tape inputs for digitation and a color display of the data. SADE is an essential tool to aid in the investigation to determine useful features as a function of time for crops and soils. Four related studies are: (1) reliability of the multivariate Gaussian assumption; (2) usefulness of transforming features with regard to the classifier probability of error; (3) advantage of selecting quantizer parameters to minimize the classifier probability of error; and (4) advantage of using contextual data. The study of transformation of variables (features), especially those experimental studies which can be completed with the SADE system, will be done. Author

N72-18196# Joint Publications Research Service, Washington, D.C.

SECOND ALL-UNION CONFERENCE ON GAME THEORY. THESES OF REPORTS AND ABSTRACTS

8 Nov. 1971 230 p refs Transl. into ENGLISH of the mono. "II Vsesoyuznaya Konferrentsiya po Teorii IGR" Vilnyus, 1971 149 p

(JPRS-54424) Avail: NTIS

General formulations of games, their hierarchial structures and dynamics, as well as various applications of game theory are reported. G.G

N72-18197*# TRW Systems Group, Redondo Beach, Calif.
IMPROVED NEUTRON ACTIVATION PREDICTION CODE SYSTEM DEVELOPMENT Final Report
R. M. Saqui Washington NASA Nov. 1971 183 p refs
(Contract NAS8-25586)
(NASA-CR-1905) Avail: NTIS CSCL 09B

Two integrated neutron activation prediction code systems have been developed by modifying and integrating existing computer programs to perform the necessary computations to determine neutron induced activation gamma ray doses and dose rates in complex geometries. Each of the two systems is comprised of three computational modules. The first program module computes the spatial and energy distribution of the neutron flux from an input source and prepares input data for the second program which performs the reaction rate, decay chain and activation gamma source calculations. A third module then accepts input prepared by the second program to compute the cumulative gamma doses and/or dose rates at specified detector locations in complex, three-dimensional geometries.
Author

N72-18198# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.
THE FEASIBILITY OF USING MINICOMPUTERS FOR REDUCING LARGE PROBLEM SOLVING COSTS
Carl F. Kottler and Robert McGill Feb. 1972 42 p refs
(RE-421) Avail: NTIS

An investigation was made of the feasibility of using minicomputers to reduce high costs associated with solving certain classes of problems on large-scale systems. It is shown that certain minicomputers which can be bought at a price equivalent to one month's rental of a large system, can provide speed and accuracy comparable to the large-scale computer at a far lower cost. A sample program run on a IBM 360/75 for analysis purposes is described in detail.
Author

N72-18199*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
DATA ACQUISITION SYSTEM FOR OPERATIONAL EARTH OBSERVATION MISSIONS
J. M. Deerwester, D. Alexander, R. D. Arno, L. E. Edsinger, S. M. Norman, K. F. Sinclair, E. L. Tindle, and R. D. Wood Washington Feb. 1972 253 p refs
(NASA-TM-X-62107) Avail: NTIS CSCL 05B

The data acquisition system capabilities expected to be available in the 1980 time period as part of operational Earth observation missions are identified. By data acquisition system is meant the sensor platform (spacecraft or aircraft), the sensors themselves and the communication system. Future capabilities and support requirements are projected for the following sensors: film camera, return beam vidicon, multispectral scanner, infrared scanner, infrared radiometer, microwave scanner, microwave radiometer, coherent side-looking radar, and scatterometer.
Author

N72-18200# RAND Corp., New York.
ARPA NETWORK SERIES. 1: INTRODUCTION TO THE ARPA NETWORK AT RAND AND TO THE RAND VIDEO GRAPHICS SYSTEM
T. O. Ellis, E. F. Harslem, J. F. Heafner, and K. U. Uncapher Sep. 1971 48 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-733049; R-664-ARPA) Avail: NTIS CSCL 09/2

An overview is given of the Advanced Research Projects Agency's experimental computer network, and a technical description of the Rand Video Graphic System that links Rand computing resources into the network. Based on principles of distributed communications without a central control point, set forth in a 1964 Rand publication series, the ARPA network has 18 nodes, located at 10 university sites, 4 research institutes (Rand, SDC, SRI, Mitre), 2 manufacturers (BB-N, Burroughs), and Rome Air Development Center. Computers of different make, model, size, speed, hardware, and software are interconnected by small special Interface Message Processor computers at each site. SRI handles all network documentation. UCLA analyzes performance statistics. BB-N coordinates maintenance and testing. Rand will experiment with information processing techniques. Network control programs are being written at each site. The video Graphic System and its relation to the network are described and illustrated.
Author (GRA)

N72-18201# Aerospace Corp., El Segundo, Calif. Lab. Operations.
ELSPEC: A COMPUTER PROGRAM FOR UNFOLDING ELECTRON ENERGY SPECTRA FROM EXPERIMENTAL ENERGY DEPOSITION PROFILES, JULY 1970 - JUNE 1971
Wendell M. Graven 1 Nov. 1971 61 p refs
(Contract F04701-71-C-0172)
(AD-733331; TR-0172(2250-3-)-2; SAMSO-TR-71-255) Avail: NTIS CSCL 09/2

A computer program for unfolding electron energy spectra from experimental deposition profiles is described. The program, called ELSPEC, has been successfully tested with stainless steel and Teflon within the electron energy range of 0.025 to 1 MeV.
Author (GRA)

N72-18202# Maryland Univ., College Park. Computer Science Center.
A STUDY OF NEW IMAGE PROCESSING TECHNIQUES Interim Report
Emily G. Johnston, Michael N. Fritz, and Azriel Rosenfield Aug. 1971 21 p refs
(Contract F19628-70-C-0208; AF Proj. 5628)
(AD-733320; SR-4; AFCRL-71-0434) Avail: NTIS CSCL 09/2

The report consists of two independent parts. The first part describes a set of computer programs designed to synthesize a class of shapes that depend on given contextual information -- specifically, the shapes assumed by water as it covers or flows over a given piece of terrain. The second part of the report contains updated information regarding the PAX II picture processing programming system in its implementation on the Univac 1108 installation at the University of Maryland.
Author (GRA)

N72-18203# Institute for Storm Research, Inc., Houston, Tex.
THE B-MALMID-4 PROGRAM: BALLISTIC MESSAGES AT ARBITRARY LOCATIONS FROM MIXED INPUT DATA Final Report, Feb. 1970 - Jun. 1971
John C. Freeman, Jr., Joseph C. Calabretta, Leon F. Graves, Troxel Ballou, and John Zeis Fort Monmouth, N. J. ECOM Jul. 1971 69 p ref
(Contract DAEA18-70-C-0115; MSA Proj. 1-0014-70; MSA Proj. 1-0017-17-70)
(AD-733419; ISR-0-04; OSD-1366; ECOM-0115-F) Avail: NTIS CSCL 09/2

The B-MALMID computer program for computing ballistic messages at arbitrary locations from mixed input data is developed along two lines: (1) There is an analysis program B-MALMID 4 for introducing new data in many forms and processing to Ballistic Messages, (2) There is a dynamic sub-routine, (3) ACTIVE LAYER model, for processing data with full use of the physics of atmospheric processes to help spread and remember data. Examples of the analysis are given using large scale and boundary layer weather estimates as input.
Author (GRA)

N72-18204# Army Foreign Science and Technology Center, Charlottesville, Va.
CONDITIONS OF EXISTENCE OF A PURSUING CONTROL
V. N. Lagunov 28 Oct. 1971 57 p refs Transl. into ENGLISH from TR. Simpozium po Vychislitelnaya Sisteman (Novosibirsk), no. 2 p 61-113
(AD-733496; FSTC-HT-23-430-71) Avail: NTIS CSCL 12/1

Pursued and pursuing objects are considered by points moving in a Euclidean n-dimensional space. These object points will be portrayed by the ends of radius vectors in some cartesian orthogonal coordinate system, where the vector Z sub 1(t) will always correspond to the pursued, and the vector, Z sub 2(t), to the pursuing object. Author (GRA)

N72-18205# Mechanical Properties Data Center, Traverse City, Mich.
MECHANICAL PROPERTIES DATA CENTER OPERATION AND DEVELOPMENT, 1969 - 1970 Final Report, 1 Nov. 1968 - 31 Oct. 1969
Robert C. Braden Wright-Patterson AFB, Ohio AFML Jul. 1971 33 p refs
(Contract F33615-69-C-1203; AF Proj. 8975)
(AD-733723; AFML-TR-70-86) Avail: NTIS CSCL 05/2

The report reviews and discusses the operation and continuing development of the Mechanical Properties Data Center. Activity and growth of the Center are discussed in terms of the five major work areas: input, file maintenance, output, systems development, and management. Author (GRA)

N72-18206# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
INTEGRATED CIRCUIT FERRITE MEMORY FOR RECIRCULATORY PURPOSES
Gabor Voros 30 Aug. 1971 14 p refs Transl. into ENGLISH from Meres Automat. (Budapest), v. 18, no. 7, 1970 p 205-208
(AD-733809; FTD-HC-23-390-71) Avail: NTIS CSCL 09/2

The paper presents the principal design requirements and their solutions for a recirculatory ferrite memory. Author (GRA)

N72-18207# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ADAPTATION OF AN ANALOG COMPUTER TESLA AP-S TO AN ITERATIVE DIFFERENTIAL ANALYZER
Stefan Szarka 24 Aug. 1971 22 p refs Transl. into ENGLISH from Automatizace (Prague), v. 13, no. 1, 1970 p 7-13
(AD-733792; FTD-HC-23-343-71) Avail: NTIS CSCL 09/2

The article mentions the means and ways of developing the memory and other special computer units of the AP-S computer necessary for analog iterative computing. Synchronous control of all operational amplifiers of the computer has been retained. Utilization of the mentioned units is illustrated by means of examples to be solved. Author (GRA)

N72-18208# International Business Machines Corp., Gaithersburg, Md.
SUMMARY OF SEVERAL SOFTWARE PACKAGES DEVELOPED FOR HUMAN ENGINEERING SYSTEMS SIMULATION (HESS)
William E. Brandt, Jr., Dale L. Wartluft, Gene M. Sebasky, and Robert G. Mills (Aerospace Med. Res. Labs.) Wright-Patterson AFB, Ohio AMRL Sep. 1971 27 p refs
(Contracts F33615-69-C-1901; F33615-70-C-1312; AF Proj. 7184)
(AD-731581; AMRL-TR-71-96) Avail: NTIS CSCL 09/2

A set of software packages and techniques developed to support research efforts, using the Human Engineering Systems Simulation Facility at the Aerospace Medical Research Laboratory, are summarized. The software discussed in this report comes under the following headings: multiple-scope processing techniques, IBM 1827 Data Control Unit subroutines, hypoxia stress studies, manned interceptor simulation, and interactive displays for anthropometry. Each of the packages is completely documented and has been made available to requesting users. Author (GRA)

N72-18209# Naval Weapons Lab., Dahlgren, Va. Science and Mathematics Research Group.
AUXILIARY PROGRAMMING FOR THE FORTRAN TYPOGRAPHIC SYSTEM
A. V. Hershey Oct. 1971 20 p refs
(AD-733989; NWL-TR-2645) Avail: NTIS CSCL 09/2

The FORTRAN Typographic System is available on three computers. For each computer the input is the same and the output is the same. The preparation of input is assisted by programming for checking and leading. Output has been obtained on a mechanical plotter and on three cathode ray printers. Variation of output is achieved through programming of conversions. Author (GRA)

N72-18210# Human Engineering Labs., Aberdeen Proving Ground, Md.
A CORRELATION PROGRAM WITH TRANSGENERATION FEATURES ADAPTED FROM THE BIOMEDICAL PROGRAM SERIES
Nicholas J. Carriero and Alfred Anderson Jun. 1971 53 p refs
(AD-733917; HEL-TM-9-71) Avail: NTIS CSCL 09/2

The report describes and gives instructions for using Biomedical Program BMD02D Correlation with Transgeneration, which was developed by the Health Sciences Computing Facility at the University of California, Los Angeles. The program has been modified for use on BRLESC II at the U.S. Army Aberdeen Research - Development Center. The report has two purposes: To discuss the various features of the program, to detail the steps that must be followed to use the program at the ARDC Computing Center in such a manner that a user with little or no programming experience may be able to make use of it.
Author (GRA)

09 ELECTRONIC EQUIPMENT

Includes electronic test equipment and maintainability; component parts, e.g., electron tubes, tunnel diodes, transistors; integrated circuitry; microminiaturization. For basic research see: 10 Electronics. For related information see also: 07 Communications and 21 Navigation.

N72-18211*# National Aeronautics and Space Administration, Washington, D.C.
PROTECTIVE DEVICE TO AVOID COMPLETE SATURATION OF A TRANSFORMER WITH A COMPOUND MAGNET CORE
Aug. 1971 5 p Transl. into ENGLISH from German Patent Application (File no. p 19 55 153.2-32, 7 Aug. 1970) 7 p
(NASA-TT-F-13946) Avail: NTIS CSCL 09A

A protective device is described that avoids the complete saturation of a transformer with a compound magnet core through primary and secondary cores of saturable magnetic material. The cores are arranged electromagnetically in parallel and are both wrapped with a common primary and secondary coil, which work together to generate a secondary output signal. The device is also equipped with primary and secondary switches which are connected to the common primary coils units which are connected with the cores and units to supply the bias windings. Author

N72-18212# Conservatoire National des Arts et Metiers, Paris (France).
STUDY AND REALIZATION OF VARACTORS DESIGNED FOR ELECTROMETRY [ETUDE ET REALISATION DE VARACTORS DESTINES A L'ELECTROMETRIE]
Guy Pierrel 3 Nov. 1971 100 p refs In FRENCH
Avail: NTIS

An analysis of the simple laws governing the functions of varactors is presented. Particular attention is given to the different physical parameters that influence the electrical characteristics and performance of the apparatus. Also described are the methods utilized to solve these problems.
Transl. by E.H.W.

N72-18213*# Raybestos-Manhattan, Inc., Passaic, N.J.
CIRCUIT BREAKER CASES Final Report
Robert L. Holmes [1971] 29 p
(Contract NAS9-11755)
(NASA-CR-115430) Avail: NTIS CSCL 09A

A flammable plastic part was duplicated dimensionally using a nonflammable material in place of the flammable plastic. The material used was L-3203-6 with a 16-hour post-cure at 400 F. Initial efforts were made to determine shrinkage tolerances required to produce a mold which would produce a finished, workable part. The final twenty-five circuit breaker cases were shipped and the metal inserts when installed, produced a workable breaker. Initial submissions of cases were rejected as lacking sufficient rigidity though they met all other requirements. The plastic cases weighed 16.5 grams, whereas the Refset cases weighed 17 grams, not meeting the less-weight requirement. The data on shrinkage determinations, and mold and part dimensions are shown. The method of manufacture is also reported. Author

N72-18214# Lockheed Missiles and Space Co., Palo Alto, Calif.
INVESTIGATION OF A CATHODE-RAY TUBE LIGHT MODULATOR WITH A COOLED KDP CRYSTAL
T. A. Kuliev, E. R. Mustel', and V. N. Parygin [1971] 6 p refs
Transl. into ENGLISH from Vestn. Mosk. Univ., Ser. 3; Fiz.-Astron. (Moscow), no. 5, 1971 p 547-552
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A cathode ray tube light modulator using a KDP electro-optical crystal was investigated at a temperature close to the Curie point. Its physical characteristics were studied experimentally, and resolution and contrast were determined. Author

N72-18215# National Bureau of Standards, Washington, D.C.
ALUMINUM WIRE TABLES
C. Peterson, J. L. Thomas, and H. Cook, eds. (Aluminum Assoc.) Feb. 1972 64 p
(NBS-Handbook-109; LC-76-189993) Avail: SOD $0.65 as C 13.11:109

Data are presented on the conductivities and resistivities of both solid and stranded wires of various sizes and composition, together with a variety of other data of interest to the designer of electrical equipment and installations. Values are expressed in both U.S. Customary and International System (SI) Units. Wire sizes involved are based on and restricted to those manufactured and typically used in the United States. American Wire Gage sizes are used for the smaller range of conductors from 56 gage through 4/0. Larger conductors are sized on the basis of circular mil area. The alloy compositions included in these tables are EC-O (annealed), EC-H19, 5005-H19, and 6201-T81; values are given over a temperature range of 0 to 100 C. Author

N72-18216*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENERALIZED REPRESENTATION OF ELECTRIC FIELDS IN INTERACTION GAPS OF KLYSTRONS AND TRAVELING WAVE TUBES WITH AXIAL SYMMETRY
Henry G. Kosmahl Washington Mar. 1972 26 p refs
(NASA-TN-D-6715; E-6689) Avail: NTIS CSCL 09A

Analytic expressions for axial and radial electric fields in axisymmetric interaction gaps of klystrons and coupled cavity traveling wave tubes are derived. Introduction of the field shape parameter m results in both limiting cases of the field at the tunnel tips, that is, E equal to a constant and E approaching infinity as well as a continuous transition between these two limits. The transition represents actual, practical fields. This representation may be used to replace the somewhat arbitrary expressions being applied by various researchers to describe the fields. Author

N72-18217# Royal Aircraft Establishment, Farnborough (England).
A THICK FILM FILTER FOR TELEVISION SIGNALS
J. R. Corkhill and M. J. Martin Aug. 1970 27 p refs
(RAE-TR-70142; BR-21614) Avail: NTIS

The performance and construction of a thick film filter for television signals is described. A computer program for linear analysis has been used to analyze the filter and the computed results are compared with measured results. Details are also given of inductor design and performance. Author

N72-18218# Sydney Univ. (Australia). Dept. of Aeronautical Engineering.
A HIGH PERFORMANCE VOLTAGE REGULATOR WITH SELF-RESETTING OVERLOAD TRIP
L. Stellema Aug. 1971 13 p
(ATN-7103) Avail: NTIS

A high performance voltage regulator with an overload protection system is described that does not have some of the disadvantages of either simple current limiting or fold-back current limiting types. It uses a tripping circuit that disables the power supply when a set current has been reached. At regular intervals, a multivibrator tries to reset the tripping circuit, succeeding only after the overload has been removed. Author

N72-18219# Naval Research Lab., Washington, D.C.
THE PREVENTION OF SURFACE ELECTRICAL LEAKAGE IN THE PRESENCE OF MOISTURE Interim Report
Hayward R. Baker and Robert N. Bolster 24 Oct. 1971 23 p refs
(AD-732378; NRL-7327) Avail: NTIS CSCL 11/3

The electrical leakage of insulation exposed to moisture, particularly when salt deposits from a marine environment are also present, can degrade the performance of electrical and electronic equipment or render it inoperative until cleaned and dried. Studies were made on the effects of prolonged bulk moisture condensation on the surface electrical resistivities of some typical insulating materials and coatings. As in the case of exposure to relative humidities below saturation, the materials of low surface energy maintained higher resistivities. Nonporous coatings with low surface energies maintained high resistivities even when applied to the poorer substrates, but porous coatings showed continual declines. The water-displacing abilities and the protection provided by several agents were evaluated, and a superior formulation was developed. This formulation rapidly displaced moisture to restore insulation resistivity, and dried to a solid film which maintained high resistivity upon reexposure to moisture. The film also protected metal parts against corrosion, but had a minimal effect on electrical contacts. This material should be useful in the maintenance of aircraft and shipboard electrical and electronic equipment and will aid in the restoration to service or temporary preservation of flooded equipment. The water-displacing action is produced by the use of n-butanol in the solvent blend. The protective film is composed of a paraffin wax, an ethylene-vinyl acetate copolymer, and an amine-acid salt corrosion inhibitor. Author (GRA)

N72-18220# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
FORMATION OF NANOSECOND PULSES OF HIGH VOLTAGE
G. A. Mesyats, A. S. Nasibor, and V. V. Kremnev 2 Nov. 1971 184 p refs Transl. into ENGLISH of the publ. "Formirovanie Nanosekundnykh Impulsov Vysokogo Napryazheniya" 1970 p 1-153
(Contract F33657-71-D-0057; FTD Proj. 7JJ)
(AD-733130; FTD-HC-23-385-71) Avail: NTIS CSCL 14/2

The document is devoted to the design and construction of devices producing pulses lasting from one to hundreds of nanoseconds of voltage ranging up to 1000 kV. A survey is given of the existing methods for producing short high-voltage pulses. Various types of circuitry for generators of high-voltage nanosecond pulses are discussed. An analysis is given of transient processes within the framework of equivalent circuits. Engineering calculations are included for the formative elements of various types of generators. Consideration is given to circuits correcting pulse waveforms, and also to circuits used to measure pulse parameters. Author (GRA)

N72-18221# Cornell Univ., Ithaca, N.Y. School of Electrical Engineering.
ADVANCED CONCEPTS OF MICROWAVE GENERATION AND CONTROL IN SOLIDS Quarterly Progress Report, 1 Apr. - 30 Jun. 1971
B. C. Dalman and L. F. Eastman Oct. 1971 177 p refs See also QPR-2, AD-727058
(Contract F30602-71-C-0110; AF Proj. 5573)
(AD-733344; RADC-TR-71-197; QPR-3) Avail: NTIS CSCL 09/1

The report deals with the progress made during the third quarterly period of a solid state microwave oscillator and amplifier research and development program. Discussed first is the progress on Gunn effect research. Work on the following specific topics is reviewed: high efficiency studies of LSA oscillators; some harmonic properties of an LSA oscillator; LSA circuit studies; control of silicon contamination in GaAs; a varactor tuned Gunn oscillator; and a Gunn effect amplifier. The progress made on a parallel program on avalanche and transit time diode devices is also described. The following specific topics are reviewed: experiments concerning harmonic generation; higher average power TRAPATT considerations; a new low noise Pt-n-p- silicon Ku-band diode; a new program on an IMPATT amplifier for FM signals; harmonic generation and frequency mixing; integrated IMPATT and TRAPATT oscillators; high-frequency high-efficiency avalanche oscillations; and measurements of IMPATT diode parameters at microwave frequencies. Finally, the progress made on the studies of solid state materials for microwave devices are reported. The topics include: ion implantation and diffusion; vacuum expitaxial growth in silicon; and ionization rates in gallium arsenide. Author (GRA)

N72-18222# Motorola, Inc., Phoenix, Ariz. Semiconductor Products Div.
HIGH RELIABILITY 225-400 MHz 50 WATT SILICON TRANSISTOR Final Report, 15 Apr. 1970 - 15 Apr. 1971
Denis S. Zoroglu Ft. Monmouth, N. J. ECOM Nov. 1971 55 p refs
(Contract DAAB07-70-C-0172-F; DA Proj. 1H6-62705-a-056)
(AD-733287; A-59; ECOM-0172-F) Avail: NTIS CSCL 09/1

High reliability NPN transistors were designed and fabricated to operate at 50-watt output power levels in the frequency range from 225 to 400 MHz with power gains in excess of 5 dB. (1) A refractory metallization system consisting of Pt-Si, NiCr, W, Au was investigated and implemented. Devices were tested for electromigration induced failures and compared to those fabricated with an aluminum based system. (2) Geometrical design, material and processing were judiciously chosen to give the devices the required output power, gain and ruggedness under load mismatch conditions. The temperature distribution across the entire surface of the chip was measured under various adverse conditions to anticipate any reliability problems. Additionally, safe operational area testing was performed to check if secondary breakdown would occur at elevated levels of dc power dissipation. Author (GRA)

N72-18223# Varian Associates, Palo Alto, Calif. Tube Div.
TRANSMITTER TUBE FOR TROPOSCATTER APPLICATION Triannual Report no. 3, 8 Feb. - 7 Jul. 1971
A. Goldfinger Oct. 1971 36 p
(Contract DAAB07-70-C-0228; DA Proj. 1H6-62705-A-055)
(AD-733426; ECOM-0228-3) Avail: NTIS CSCL 09/1

The objective of this program is to establish the design criteria for a high efficiency, high gain, high power klystron final amplifier operating in the 4.4 to 5.0 GHz range. The klystron final amplifier is defined as the klystron tube plus its focusing and cooling systems. The power level is 10 kilowatts cw and the objective efficiency of the final amplifier is 47%. During the third report period, all detail design drawings were completed for the high efficiency klystron and its electromagnet. The electromagnet was ordered, received and tested to design specifications. The major effort of this period was devoted to the fabrication of the high efficiency demonstration klystron, which was successfully completed near the end of the present report period. Author (GRA)

N72-18224# Watkins-Johnson Co., Palo Alto, Calif.
ELECTRON BOMBARDED SEMICONDUCTOR SHORT PULSE GENERATOR Triannual Report, 1 Apr. - 31 Jul. 1971
Aris Silzars Nov. 1971 43 p
(Contract DAAB07-70-C-0268)
(AD-733427; W-J-22-4083-3; ECOM-0268-3) Avail: NTIS CSCL 09/5

The fabrication, processing and preliminary testing of three EBS high-current high-speed pulse amplifiers were completed. Transconductance of the cathodegrid structure was measured and over 80 percent of the design goal performance has been obtained. Semiconductor target fabrication continued. Large area targets of 0.35 sq cm and 1.40 sq cm active area were successfully fabricated. The diodes have leakage currents of less than 10 mA at 200V reverse breakdown voltage. Three tubes were processed through 275C bakeout and cathode activation with no change in the diode characteristics. Preliminary pulse tests were made on the processed tubes. Twenty ampheres with 4 ns rise time were obtained from a tube with 0.35 sq cm semiconductor target active area. Eighty amperes with 10 ns risetime into 1/2 ohm load were obtained from a tube with 1.40 sq cm target. No change in diode reverse breakdown voltage was observed during pulse operation of the high-current amplifiers. Author (GRA)

N72-18225# General Electric Co., Schenectady, N.Y. Corporate Research and Development.
TWO PHASE FLUID COOLED INDUCTION MOTOR PROGRAM Final Report
B. W. Merchant and R. F. Edgar Jun. 1971 134 p refs
(Contract DAAK02-69-C-0510; DA Proj. 1T662705-01204)
(AD-733489; S-71-1122) Avail: NTIS CSCL 09/3

The purpose of the program was to demonstrate the feasibility of operating electric motors at higher power densities than attainable in motors of conventional design. An investigative phase of this program covered a variety of electromagnetic/mechanical design techniques in conjunction with several types of cooling techniques. After evaluation, two-phase fluid cooling using heat pipes was selected for development and an induction motor was built and tested at steady state power levels to 12.6 hp at 12,000 rpm. Heat pipes were used to increase the rate of heat removal in both the stator and the rotor. The heat pipes in the rotor acted as both electrical and thermal conductors while those in the stator were installed in the center of the stator slot to act as thermal conductors. Author (GRA)

N72-18226# Aerospace Corp., El Segundo, Calif. Lab. Operations.
LINEAR-ARRAY AND FEED-NETWORK PERFORMANCE IN A REENTRY PLASMA ENVIRONMENT, AUGUST DECEMBER 1970
Kurt E. Golden and Gordon E. Stewart Sep. 1971 49 p refs
(Contract F04701-71-C-0172)
(AD-733841; TR-0172(2220-10)-2; SAMSO-TR-71-191) Avail: NTIS CSCL 09/5

A ten-element linear-phased array on an inhomogeneous dielectric or plasma-clad ground plane is analyzed, and the numerical results are compared with input-admittance, antenna-gain, and radiation-pattern measurements in free space and simulated low-altitude reentry environments. The analysis includes internal feed performance, external mutual coupling, element pattern distortion, input admittance, aperture voltage, and resulting antenna-gain calculations. Author (GRA)

N72-18227# Illinois Univ., Urbana. Coordinated Science Lab.

ON THE ORDERING OF CONNECTIONS FOR AUTOMATIC WIRE ROUTING

Luther C. Abel Nov. 1971 28 p refs
(Contracts DAAB07-67-C-0199; DAHC04-72-C-0001; AF 30(602)-4144; Grant NSF GK-15459)
(AD-733861; R-537; UILU-ENG-71-2240) Avail: NTIS CSCL 09/5

Most wire routing programs utilize a maze-running technique to route one connection at a time. Once routed, a wire cannot be moved even if it is subsequently discovered to interfere with the successful completion of other connections. The order in which the desired connections are presented to the routing algorithm has therefore been thought to be of critical importance. Experimental evidence is presented herein, however, to show that the performance of a router, when measured in terms of the total of the minimum (or ideal) lengths of the connections successfully completed, is in fact independent of the order in which connections are attempted. Author (GRA)

N72-18228# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE STATE OF INVESTIGATION IN THE FIELD OF SWITCHES AND FUSES IN POLAND

Stanislaw Dzierzbicki 18 Oct. 1971 15 p Transl. into ENGLISH from Przegl. Elektron. (Poland), v. 46, no. 11, 1970 p 451-456
(AF Proj. 3145)
(AD-734057; FTD-HC-23-859-71) Avail: NTIS CSCL 09/1

The report discusses the following: Investigations on arc burning freely in air and its electrodes; Investigations on increase of the strength of post-arcing gap of the arc burning freely in air; Investigations on methods of designing narrow-slot interruption chambers; Investigations on gas-blowout circuit breakers; Investigations on vacuum switches; Investigations on arc in a stream of compressed gas and its suppression; Investigations on reverse voltages and switching overvoltages; Investigations on fuses with sand. GRA

N72-18229# Army Electronics Command, Fort Monmouth, N.J.

KWIC INDEX OF TECHNICAL PAPERS, INTERNATIONAL WIRE AND CABLE SYMPOSIA (1952 - 1971)

Jack Spergel, comp. Nov. 1971 83 p refs
(AD-734000) Avail: NTIS CSCL 09/1

The bibliography lists 502 technical papers presented at International Wire and Cable Symposia from 1952 through 1971. The citations are grouped by symposium number and two indexes are provided: A Key Work in Context (KWIC) index for retrieval of titles by subject, and an author index. Among the broad subject areas covered in the bibliography are: Military and aerospace electronics; telephone communications; electronic wiring; cable design, test, and performance; evaluation; and related fields of chemistry and electrical engineering. Author (GRA)

N72-18230# Army Electronics Command, Fort Monmouth, N.J.

PROCEEDINGS OF THE TWENTIETH INTERNATIONAL WIRE AND CABLE SYMPOSIUM

1971 382 p refs Conf. held at Atlantic City, N. J., 30 Nov. - 2 Dec. 1971
(AD-733999) Avail: NTIS CSCL 09/1

Contents: Tutorial session on insulating and jacketing materials and application to telephone cable; Coaxial cable for PCM and broadband transmission; Conductors, insulated wire and assemblies; Manufacturing techniques and processes for communication cable; Telephone cable materials; Cable design, testing and high voltage characteristics. GRA

10 ELECTRONICS

Includes circuit theory; and feedback and control theory. For applications see: 09 Electronic Equipment. For related information see specific Physics categories.

N72-18231*# Maryland Univ., College Park. Computer Science Dept.

GENET NOTE NO. 1

Jeffry W. Yeh Dec. 1971 117 p refs
(Grant NGR-21-002-197)
(NASA-CR-122354) Avail: NTIS CSCL 09C

The general features of the GENET system for simulating networks are described. A set of features is presented which are desirable for network simulations and which are expected to be achieved by this system. Among these features are: (1) two level network modeling; and (2) problem oriented operations. Several typical network systems are modeled in GENET framework to illustrate various of the features and to show its applicability. Author

N72-18232*# Ampex Corp., Redwood City, Calif. Research and Advanced Technology Div.

BATCH FABRICATION PROCESS DEVELOPMENT FOR FERRITE LOGIC CONDUCTORS

C. H. Heckler, Jr. and N. C. Bhiwandker Feb. 1972 63 p refs
(Contract NAS1-9836)
(NASA-CR-111983; RR71-15) Avail: NTIS CSCL 09C

A process for fabricating ultrareliable magnetic ferrite logic circuits is described in which the conductors are formed by a combination of two batch type processes - photolithography and electroplating - and a mechanized writing process for completing conductors in the third dimension. Up to 4 turns, through an aperture 1 mm in diameter, are formed by the described process. The number of joints in the conductors is reduced by use of this process to only those which are required for input, output and power connections of a logic block. To demonstrate feasibility, 8-stage magnetic ring counter circuits have been fabricated. Author

N72-18233# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.

MACROWAVE SYSTEM IN CAVITY FOR COMPLEX DIELECTRIC CONSTANT MEASUREMENTS

A. Bonincontro, C. Cametti, and L. Simonelli 1 Mar. 1971 27 p refs
(ISS-71/2) Avail: NTIS

A microwave circuit for measurements of complex dielectric constants of solid or liquid samples by cavity perturbation method is described. The main feature of the circuit is to use a system of beats to measure the quality factor and the shift of resonance frequency with high accuracy and consequently to determine the complex dielectric constant of the sample. Author

N72-18234*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN, PERFORMANCE, AND EVALUATION OF A DIRECT-CURRENT CONTACTOR FOR SPACE NUCLEAR ELECTRICAL SYSTEMS

Lawrence A. Mueller, David W. Medwid, Ernest A. Koutnik, and A. Hamilton Powell Washington Mar. 1972 23 p refs
(NASA-TN-D-6699; E-6627) Avail: NTIS CSCL 09C

A direct-current contactor for use in large space power systems was designed, built, and tested. It was developed to be operational in an environment of 540 C and at a pressure of 0.0001 N/sq m or lower. The contactor is rated to pass 10 A continuously and to interrupt a 20-A current at 10,000 V. It was tested to determine the corona threshold level and the leakage current at different temperatures. Also, it was tested for its closing and interruption ability. Author

N72-18235# National Bureau of Standards, Washington, D.C.
ELECTROMAGNETIC MULTIPOLE TRANSITIONS IN THE RECOUPLING PICTURE, OR ELECTRON SCATTERING WITHOUT CURLS Final Report
J. S. OConnell Feb. 1972 23 p refs
(NBS Proj. 2410231)
(NBS-TN-713) Avail: SOD $0.30 as C-13.46:713

The formation of the multipole operators from the fundamental charge, current, and moment operators of electron-nucleus scattering is carried through as an angular momentum recoupling problem rather than the usual vector algebra derivation. This point of view allows the electric and magnetic transition operators to be obtained in a simple and intuitive manner. The single particle reduced matrix elements of the charge, current, and moment operators are then calculated in the j-j coupling scheme using a flow chart technique developed by Danos. Author

N72-18236# National Research Council of Canada, Ottawa (Ontario).
TRANSIENT PHENOMENA IN THE MARX-TYPE MULTIPLIER CIRCUIT AFTER FIRING THE FIRST SWITCHING SPARK GAP
A. Rodewald 1972 28 p refs Transl. into ENGLISH from Bull. Schweiz. Elektrotech. Ver. (Switzerland), v. 60, no. 2, 1969 p 37-44
(NRC-TT-1516) Avail: NTIS

The transient processes after the firing of the first switching spark gap in the Marx-type multiplier circuit are investigated experimentally. The test results are described in terms of a simple equivalent diagram. The equivalent diagram comprises a series of resistances with longitudinal and transverse capacitance. The series of resistances is formed by the resistances inserted between the individual generator stages. The so-called discharge resistances here play the principal part. The longitudinal and transverse capacitances in the circuit are provided by the stray capacitances between the neighbouring generator stages and the stray capacitances of the generator stages relative to earth. The generally capacitive loading of the generator in the case of the observed rapid transient processes acts as a short circuit at the output of the series. The longitudinal voltages in the individual states of the series appear as overvoltages at the corresponding switching spark gaps. The firing of a switching spark gap as the result of such an overvoltage is oscillographed. Author

N72-18237# California Univ., Los Angeles. Dept. of Mathematics.
ON THE OPTIMUM STEP RESPONSE OF BANDLIMITED SYSTEMS
Victor Barcilon 18 Nov. 1971 19 p refs
(Contract N00014-69-A-0200-4022; NR Proj. 044-144)
(AD-733473) Avail: NTIS CSCL 09/5

The following bounds for the overshoot/undershoot epsilon of the unit step response of a bandlimited system are derived: 1/pi the integral from omega(O)T to infinity of (K sub O (Xi)dXi)-epsilon-(1/pi)(K sub O)(omega sub O)T), where 2T is the rise time, (-omega sub O, omega sub O) the bandwidth and K sub O the zeroth order modified Bessel function of the second kind. The suboptimal response corresponding to the upper bound is also discussed. Author (GRA)

N72-18238# *Naval Postgraduate School, Monterey, Calif.*
AN ANALYSIS OF PHASE-LOCKED LOOPS M.S. Thesis
Marvin Joseph Weniger Sep. 1971 271 p refs
(AD-733202) Avail: NTIS CSCL 09/3

An investigation was conducted of a third order type two phase-locked loop with a sawtooth phase comparator using both analog and digital simulation techniques and employing an exact system simulation. The results are presented in terms of normalized system parameters and give the system performance as a function of the initial phase between the input and the VCO waveforms, the variation of the input from the VCO frequency, and the system gain and filter characteristics. Some of the data presented includes the time required for the system to meet different types of lock criterion together with the range of frequencies over which the system will lock and the range over which it will lock without cycle skipping. Investigations were conducted of the system performance for eight different types of phase comparators, of which two of the basic forms had been used previously and the rest were new with this work. It was found that two of the new forms, the R-S nonlinear and the additive with ramp nonlinearity exhibited significantly superior performance in that they possessed increased lock ranges, reduced lock times, and greater values of seize frequency than did the basic systems from which they were derived. It was found that three of the phase comparators yielded an unlimited lock range, even though the lock time became quite long for very large frequency variations. Author (GRA)

N72-18239# Rome Air Development Center, Griffiss AFB, N.Y.
PULSE POWER TESTING OF MICROCIRCUITS
Jack S. Smith Oct. 1971 59 p refs
(AD-733342; RADC-TR-71-59) Avail: NTIS CSCL 09/5

Failure analysis of microcircuits subjected to high current transient pulses (ranging from 100 nanoseconds to 10 microseconds in duration) has shown the principal cause of failure to be junction shorting (98%) as opposed to metallization burn-out (2%). However, in the dielectrically isolated, thin film resistor technology, the weakest link was the susceptibility of the thin film resistors to the transient pulse. Author (GRA)

N72-18240# Hughes Aircraft Co., Culver City, Calif. Electronic Properties Information Center.
THICK FILM DIELECTRIC FUNCTIONAL INKS AND PASTES Interim Report
Apr. 1971 53 p refs
(Contract F33615-70-C-1348)
(AD-733253; EPIC-IR-78) Avail: NTIS CSCL 09/5

The report presents information and data on dielectric glaze ink and paste formulations used in microelectronics technology. The report includes information on the chemical composition processing information, electrical properties, vendor suppliers, and applications. Author (GRA)

N72-18241# *Illinois Univ., Urbana.*
MODULAR DECOMPOSITION OF COMBINATIONAL SWITCHING NETWORKS
Douglas Charles Schmidt Sep. 1971 134 p refs
(Contract DAAB07-67-C-0199; Grant NSF GK-15459)
(AD-733859; R-535; UILU-ENG-71-2238) Avail: NTIS CSCL 09/2

The problem of designing a combinational network from a library of fixed configuration, fanout-free modules is investigated. The approach developed consists of two phases: (1) A loop-free combinational network is designed without constraints. (2) The design is translated into terms of the module library. Emphasis is placed on the second phase of this process. A procedure is presented which generates all possible different types of modes (gates) that may be formed by a module. Theorems are then developed which state the necessary and sufficient conditions for a set of modes to be capable of replacing a set of gates and a network. The necessary and sufficient conditions are formulated as integer linear programs which can be used to minimize cost function over any fanout-free network. Author (GRA)

11 FACILITIES, RESEARCH AND SUPPORT

Includes airports; lunar and planetary bases including associated vehicles; ground support systems; related logistics; simulators; test facilities (e.g., rocket engine test stands, shock tubes, and wind tunnels); test ranges; and tracking stations.

N72-18242# Stichting Nationaal Lucht- en Ruimtevaartlaboratorium, Delft (Netherlands).
STICHTING NATIONAL AIR AND SPACEFLIGHT LABORATORY REPORT FOR THE YEAR 1970 [VERSLAG OVER HET JAAR 1970 STICHTING NATIONAAL LUCHT- EN RUIMTEVAARTLABORATORIUM]
1970 107 p refs
Avail: NTIS

Research activities are reported in the following fields of interests: applied aeronautical research for air traffic control and temperature distribution in spacecraft; aerodynamic evaluation of aircraft structures; flight mechanics and aircraft operations; space flight technology for development of ELDO launch vehicle; applied mathematics in data handling and computer operations; and development of test equipment and flight simulators. G.G.

N72-18243# Academy of Sciences (USSR), Moscow.
LUNAR MOBILE LABORATORY LUNOKHOD 1
A. P. Vinogradov, ed. 1971 144 p refs In RUSSIAN
Avail: NTIS

Luna 17 and Lunokhod 1 space vehicle systems are described, including television, heating, power supplies, spacecraft control and guidance, and spacecraft components. Research on lunar topography, soils, rocks, and cosmic rays are noted. For individual titles, see N72-18244 through N72-18254.

N72-18244# Academy of Sciences (USSR), Moscow.
THE BASIC APPARATUS AND LAYOUT OF THE LUNA 17 SPACE PROBE c31
K. S. Anisov, V. I. Mastakov, O. G. Ivanov, L. N. Leonidov, G. N. Nikolayev, A. D. Dneprov, A. K. Alksandrov, P. S. Semenov, A. F. Grachev, V. I. Komarov et al *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 7-20 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

Construction of the Luna 17 space station is described. The means of moving the landing stage, as well as the landing stage itself, are considered. The apparatus for attaching the moon rover to the landing stage is presented in detail. The moon rover chassis is also described. Transl. by K.P.D.

N72-18245# Academy of Sciences (USSR), Moscow.
THE RADIO COMPLEX, CONTROL SYSTEMS, AND ELECTRIC POWER SUPPLY c03
V. P. Puchkov, L. L. Puchenko, F. I. Babkov, R. O. Belova, O. G. Ivanov, V. I. Malin, A. S. Makov, I. B. Merkov, Ye. G. Uzkiy, N. A. Zheleznov et al *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 21-29 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The control system of the Luna 17 space probe is described. The system for stellar orientation is considered. The radio apparatus and the antenna-feeder system are also described. The electric power supply of both Luna 17 and the Lunokhod 1 lunar roving vehicle are presented. Transl. by K.P.D.

N72-18246# Academy of Sciences (USSR), Moscow.
HEATING CONDITIONS AND THE SYSTEM FOR HEAT REGULATION
A. I. Yelenov, A. M. Rybin, and A. S. Yakovlev *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 30-33 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The heat regime on the Luna 17 space probe on the earth-moon flight and on the Lunokhod 1 rover are described. The general equipment and the thermal regulatory system on a moon rover are reviewed. Transl. by K.P.D.

N72-18247# Academy of Sciences (USSR), Moscow.
MANAGEMENT AND RESULTS OF THE PROGRAM COMPLETION c34
A. A. Aleksandrov, P. A. Artemyev, G. I. Bogatov, I. A. Yelenov, O. G. Ivanov, V. A. Rybkina, Ye. G. Uzkiy, A. I. Shakhov, F. P. Pavlov, Yu. P. Kotlov et al *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 34-54 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The system for controlling a lunar roving vehicle at a distance is outlined. The flight and landing operations of the Luna 17 space probe are presented. A flight log is included. The execution of research experiments on the moon by means of the self-operating equipment on the Lunokhod 1 is described. A log of the work performed by Lunokhod 1 during three 24-hour periods is given. Flight control of Luna 17 and operating control of Lunokhod 1 are also considered. Transl. by K.P.D.

N72-18248# Academy of Sciences (USSR), Moscow.
STRUCTURAL FEATURES AND BASIC PARAMETERS OF THE LUNOKHOD 1 TELEVISION SYSTEMS c07
A. S. Selivanov, V. M. Govorov, V. V. Zasetskiy, and V. A. Timokhin *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 55-64 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The television equipment and panoramic television system are described. The electronic microframe television system is also reviewed. Transl. by K.P.D.

N72-18249# Academy of Sciences (USSR), Moscow.
STUDY OF THE TOPOGRAPHY OF THE REGION ALONG THE PATH OF LUNOKHOD 1 c30
B. N. Rodionov, B. V. Nepoklonov, and V. V. Kiselev *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 65-73 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

Characteristic problems associated with study of lunar topography by Lunokhod 1 are analyzed. A topographic survey along the Lunokhod 1 path of movement is presented. A photogrammetric analysis of the television images was undertaken, and the mathematical aspects are presented. Navigational computations were utilized in order to plot the survey traces. An outline of topographic features on the Lunokhod path is given. Transl. by K.P.D.

N72-18250# Academy of Sciences (USSR), Moscow.
DETERMINATION OF THE GEOMETRIC DIMENSIONS AND DISTRIBUTION OF CRATERS ENCOUNTERED BY THE LUNOKHOD 1 PROBE ON THE MOON'S SURFACE c30
V. I. Garin, A. K. Leonovich, F. P. Pavlov, V. B. Georgiyev, and P. S. Semenov *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 74-77 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

A mathematical analysis is presented for lunar crater positions and dimensions based on Lunokhod data. Transl. by K.P.D.

N72-18251# Academy of Sciences (USSR), Moscow.
OBSERVATIONS OF THE MECHANICAL PROPERTIES OF THE LUNAR SOIL BY THE SELF-PROPELLED APPARATUS LUNOKHOD 1 c30
A. K. Leonovich, V. V. Gromov, A. V. Rybakov, V. K. Petrov, P. S. Pavlov, I. I. Cherkasov, and V. V. Shvarev *In its* Lunar Mobile

Lab. Lunokhod 1 1971 p 78-88 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The aims and methods involved in studying the mechanical properties of lunar soil are examined. The apparatus used on the Lunokhod 1 roving vehicle is described. Among the properties studied were structure and deformation, depth of the upper fine grained soil layer, and engineering properties of the soil, rocks, and other lunar formations. Transl. by K.P.D.

N72-18252# Academy of Sciences (USSR), Moscow.
THE LUNAR AUTOMATIC SPECTROMETER RIFMA c14
G. Ye. Kocharov, N. F. Borodulin, S. V. Viktorov, O. M. Voropayev, A. Yu. Dzevanovskaya, O. G. Ivanov, G. V. Kiryan, V. V. Petrov, and V. A. Sakulskiy *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 89-95 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The geometry and method of operation of the Rifma instrument are considered. A schematic of the equipment is presented. This apparatus was used on the Lunokhod 1 vehicle for rapid chemical analysis of soils using X-ray spectrometry. Transl. by K.P.D.

N72-18253# Academy of Sciences (USSR), Moscow.
PRELIMINARY RESULTS OF GEOMORPHOLOGIC STUDIES c30
K. P. Florenskiy, A. T. Bazilevskiy, A. A. Pronin, and Z. V. Popova *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 96-115 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

The general features of the area of research, the Sea of Rains, are outlined. Preliminary results of panoramic studies include data on the craters of the region (morphology, surface distribution, density distribution), rocks (morphologic forms, and surface and density distributions), and structure of the regolith (surface structure, granulometric composition, and strength). Transl. by K.P.D.

N72-18254# Academy of Sciences (USSR), Moscow.
STUDY OF COSMIC RAYS c29
S. N. Vernov, G. P. Lyubimov, Ye. A. Chuchkov, and N. N. Kontor *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 116-125 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

Equipment used on Lunokhod 1 for cosmic ray studies is described. Principles of operation and detector characteristics are included. Preliminary results are presented which were obtained on the flight trajectory to the moon, and during the first through fourth lunar days. Transl. by K.P.D.

N72-18255*# Rensselaer Polytechnic Inst., Troy, N.Y.
AN OPTIMAL SYSTEM DESIGN PROCESS FOR A MARS ROVING VEHICLE
C. Pavarini, J. Baker, and A. Goldberg Nov. 1971 76 p refs
(Grant NGL-33-018-091)
(NASA-CR-125615; RPI-TR-MP-24) Avail: NTIS CSCL 13F

The problem of determining the optimal design for a Mars roving vehicle is considered. A system model is generated by consideration of the physical constraints on the design parameters and the requirement that the system be deliverable to the Mars surface. An expression which evaluates system performance relative to mission goals as a function of the design parameters only is developed. The use of nonlinear programming techniques to optimize the design is proposed and an example considering only two of the vehicle subsystems is formulated and solved. Author

N72-18256# Aktiebolaget Rollab, Stockholm (Sweden).
THE CONTINUOUSLY VARIABLE WIND TUNNEL NOZZLE OPERATED ONE SINGLE SCREW MECHANISM
1 Mar. 1970 51 p refs Original contains color illustrations
(RR-018) Avail: NTIS

A single screw continuously variable nozzle for varying the Mach number in supersonic wind tunnels is described along with its working principles, design features, and performance. Various facilities using this nozzle are also briefly described. F.O.S.

N72-18257# National Bureau of Standards, Boulder, Colo. Time and Frequency Div.
NBS FREQUENCY-TIME BROADCAST STATION WWN, FORT COLLINS, COLORADO Final Report, 1965 - 1966
Peter P. Viezbicke Oct. 1971 29 p refs
(NBS Proj. 2730121)
(NBS-TN-611) Avail: SOD $0.35 as C 13.46:611

The design and construction of the National Bureau of Standards frequency-time broadcast station located at Fort Collins, Colorado is described. The principal function of the station is to broadcast basic standards of frequency and time signals on frequencies of 2.5, 5, 10, 15, 20, and 25 MHz. These high frequency transmissions, which can be received on the simplest of equipment, provide the necessary accuracy required to fulfill some of the needs of industry, government, and the public. The technical and administrative supervision of the station is under the Time and Frequency Division, Frequency-Time Broadcast Services Section, National Bureau of Standards, Boulder, Colorado. Author

N72-18258# National Research Council of Canada, Ottawa (Ontario).
DIVISION OF MECHANICAL ENGINEERING AND THE NATIONAL AERONAUTICAL ESTABLISHMENT Quarterly Bulletin, 1 Oct. - 31 Dec. 1971
31 Dec. 1971 84 p refs
(DME/NAE-1971(4)) Avail: NTIS

A mechanical engineering bulletin, containing research and development data in various scientific fields, is presented. Data given for this period include effects of turbulent wind pressure on structural stability of tall urban buildings, engineering designs for an acoustic research facility, and the effects of non-ionizing electromagnetic radiation effects on different living organisms including man. For individual titles, see N72-18259 through N72-18261.

N72-18259# National Aeronautical Establishment, Ottawa (Ontario). Low Speed Aerodynamics Lab.
A WIND TUNNEL AND FULL-SCALE STUDY OF TURBULENT WIND PRESSURES ON A TALL BUILDING
N. M. Standen, W. A. Dalgliesh, and R. J. Templin *In* Natl. Res. Council of Can. Div. of Mech. Eng. and the Natl. Aeron. Est. 31 Dec. 1971 p 1-13 refs (See N72-18258 09-11)
Avail: NTIS

A method is described for simulating the natural wind boundary layer in a conventional, short working section, aeronautical wind tunnel. The boundary layers, which may be as thick as one-half of the working section height, are generated by spires at the working section inlet. This approach was used to measure mean wind pressures and pressure spectra on a model of a tall building in downtown Montreal. The same measurements were repeated using the long roughness fetch technique for boundary layer generation and the results from the two methods are compared. An extensive program of full scale measurements of wind pressures was completed on the Montreal building. These data are reviewed and a comparison is made between full scale and model values of mean wind pressures and pressure spectra. Author

N72-18260# National Research Council of Canada, Ottawa (Ontario). Engine Lab.
PROPOSAL FOR AN ENGINEERING ACOUSTIC RESEARCH LABORATORY
E. P. Cockshutt, M. S. Chappell, and G. E. Mair *In its* Div. of Mech. Eng. and the Natl. Aeron. Est. 31 Dec. 1971 p 15-36

refs (See N72-18258 09-11)
Avail: NTIS

A description is given of an acoustic laboratory, proposed for heavy engineering research and development, as opposed to small scale acoustic experiments. The laboratory is intended as a support facility for Canadian industry and for Canadian operators; as such it may be considered analogous to wind tunnels or to environmental chambers. The laboratory specifications were generated around engine type applications; these turn out to be particularly demanding because of: the airflow handling requirements; the very high noise levels present; and the multiplicity of simultaneous noise generating mechanisms. However, once a laboratory is available to cope with engine studies, then it will also cope with a very wide range of engineering and commercial equipment. Author

N72-18261# National Research Council of Canada, Ottawa (Ontario). Control Systems Lab.
NONIONIZING ELECTROMAGNETIC RADIATION AND POLLUTION OF THE ATMOSPHERE c04
J. A. Tanner and C. Romero-Sierra (Queens Univ., Kingston, Ontario) *In its* Div. of Mech. Eng. and the Natl. Aeron. Est. 31 Dec. 1971 p 37-45 refs (See N72-18258 09-11)
Avail: NTIS

The side effects and some of the advantages of the interaction between electromagnetic radiation and living organisms are examined. Results show harmful side effects are: (1) demyelination of peripheral nerves in cats, (2) changes in EEG patterns in domestic fowl, (3) physical collapse in young chickens, and (4) wilting and death of plants. One advantage of electromagnetic radiation is that under short and low intensity exposure, egg production in chickens is increased. The possible effects on human systems are also explored. E.H.W.

N72-18262# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
A DIGITIZED PROTON RANGE SPARK CHAMBER BETWEEN 60 AND 150 MeV
R. Giordano, G. Grisanti, and P. Salvadori 16 Jul. 1971 63 p refs In ITALIAN; ENGLISH summary
(ISS-71/15) Avail: NTIS

The digitizing system and the particular criteria adopted for track reconstruction are outlined. Preliminary tests with cosmic rays were carried out performing an automatic data acquisition by means of an on-line IBM 1800 computer. Author

N72-18263*# Naval Ordnance Lab., White Oak, Md.
THE NOL BALLISTIC PISTON COMPRESSOR 2: OPERATION UP TO 5,000 ATM
Gordon L. Hammond and George T. Lalos 16 Dec. 1971 61 p refs
(NASA-CR-120844; NOLTR-71-228) Avail: NTIS CSCL 14B

Experiments are described which demonstrated the feasibility of rapidly compressing inert gases in a ballistic piston compressor to simultaneously high temperatures and densities previously unobtainable in the laboratory. With argon, temperatures of the order of 6000 K and accompanying densities of the order of 100 Amagats have been obtained; and with nitrogen, temperatures and densities of 3000 K and 400 Amagats have been approached. Details of the design, assembly, instrumentation, and operating procedures are presented, and the results of mechanical and thermal performance tests up to 5000 atmospheres pressure are described. Emphasis is placed on experiments which demonstrated the usefulness of this apparatus for spectral line broadening studies. Author

N72-18264*# Translation Consultants, Ltd., Arlington, Va.
METEOROLOGICAL ROCKET COMPLEX M-100 USED FOR ATMOSPHERIC SOUNDING IN THE USSR
Washington NASA Mar. 1972 29 p Transl. into ENGLISH of "Meteorol. Raketnyy Kompleks M-100 Primenyayushchiysya Dlya Zondirovaniya Atmosfery v SSSR" (unpublished report) Moscow, Hydrometeorol. Serv. of the USSR, 1971 24 p
(Contract NASw-2038)
(NASA-TT-F-14205) Avail: NTIS CSCL 22D

The M-100 meteorological rocket, its instrumentation, and operating principles, are described. The procedure used to process measurements obtained, and the use to which these measurements are put, are discussed. Author

N72-18265# Royal Aircraft Establishment, Farnborough (England).
SOME PRELIMINARY STUDIES OF FACTORS INFLUENCING AIRPORT CAPACITY INCLUDING CURVED FINAL APPROACH PATHS
N. H. Hughes, K. Watling, and R. A. Harlow Mar. 1971 43 p refs
(RAE-TR-71059; BR-25181) Avail: NTIS

Fast-time simulation is used to examine the airport capacity benefit resulting from the use of a guidance and control system which permits curved final approach paths. The benefit is compared with that obtainable by other means such as parallel runway operation and reduced longitudinal separation at the approach gate. It is shown that a capacity improvement can be obtained from curved approach paths in the case of a runway used for arrivals only, but this disappears when the runway handles mixed arrivals and departures. It is concluded that the way in which ATC operates the airport has a strong influence on the benefit realizable from applications of R & D to the capacity problem, and it is considered that further studies in depth are required to establish how ATC can take fullest advantage from such systems as area navigation and wide coverage approach and departure guidance. Author

N72-18266# Naval Postgraduate School, Monterey, Calif.
INCORPORATION OF THE SIX DIMENSIONAL, LINEARIZED EQUATIONS OF MOTION WITH A VARIABLE STABILITY FLIGHT SIMULATOR M.S. Thesis
Merlin Richard Huckemeyer Sep. 1971 38 p refs
(AD-733181) Avail: NTIS CSCL 14/2

In this report the equations of motion for the six degrees of freedom of an aircraft were solved by an analog computer circuit. These solutions were incorporated with the instrumentation of a fixed base flight simulator to provide a variable stability aircraft demonstration device. Author (GRA)

N72-18267# Naval Postgraduate School, Monterey, Calif.
A VISUAL APPROACH AND LANDING SIMULATOR SYSTEM M.S. Thesis
James Nicholas Kraft Sep. 1971 35 p refs
(AD-733240) Avail: NTIS CSCL 14/2

An F-105 Canopy/Seat Cockpit Trainer, Panasonic Television Monitor System, and an SMK-22 Visual Approach Simulator were interfaced to yield a low-cost, six-degree-of-freedom visual approach and landing simulation system for future research and classroom use. Stick and throttle outputs from the cockpit were made to operate all six degrees of freedom. The television monitor was mounted forward of the cockpit instrument panel to provide visual cues for approaches, landings, and take-offs. Cockpit instruments consist of airspeed, altimeter, and ID-249 ILS indicators. Author (GRA)

N72-18268# Army Test and Evaluation Command, Aberdeen Proving Ground, Md.
CLIMATIC HANGAR TESTING Final Report
1 Nov. 1971 14 p
(AMCR Proj. 310-6)
(AD-733299; MTP-7-3-521) Avail: NTIS CSCL 01/5

The report describes a method for evaluation of Army aircraft materiel climatic effects and provides procedures for test preparation, initial inspection, electrical power requirements, installation characteristics, climatic operational performance characteristics, maintenance evaluation, safety, human factors, and personnel training requirements. Author (GRA)

N72-18269# Bunker-Ramo Corp., Westlake Village, Calif. Electronic Systems Div.

TRAINING EFFECTIVENESS EVALUATION OF NAVAL TRAINING DEVICES. PART 2: A STUDY OF DEVICE 2F66A (S-2E TRAINER) EFFECTIVENESS

David Meister, D. J. Sullivan, E. A. Thompson, and D. L. Finley Orlando, Fla. Naval Training Device Center Jul. 1971 110 p refs
(Contract N61339-69-C-0322)
(AD-732795; J93-1U1-Pt-2; NAVTRADEVCEN-69-C-0322-2) Avail: NTIS CSCL 05/9

The study examined the effectiveness of Device 2F66A (S-2E aircraft) in training crew members to perform air antisubmarine warfare missions. Data collection was made through daily on-site observation, and four types of data were collected. Results generally indicated that the trainer was effective with all crew members, that beginning students benefitted more than operational and reserve personnel, and that important improvements in training for all personnel could be effected through improved systematic utilization of existing training devices. Recommendations for improved use of capabilities include: more systematic variations of the training session, increased trainer usage, and more systematic utilization of the trainer in both individual positions and team training modes. Author (GRA)

N72-18270# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE COLLECTIVE ION ACCELERATOR. A NEW EXPERIMENT IN THE PHYSICS OF ELEMENTARY PARTICLES

V. P. Sarantsev 20 Oct. 1971 16 p Transl. into ENGLISH from Proceedings of 4th United Nations Intern. Conf. on the Peaceful Uses of Atomic Energy, Geneva, 6-16 Sep. 1971 p 1-13
(FTD Proj. 7JJ)
(AD-733862; FTD-23-1630-71) Avail: NTIS CSCL 20/7

The article discusses in general terms the state of the art of collective ion accelerator technology and the prospects of further development and applications of ultrahigh energy accelerators. Author (GRA)

N72-18271# Defense Documentation Center, Alexandria, Va.

NON-DESTRUCTIVE TESTING: RADIOGRAPHY Report Bibliography, Mar. 1964 - Dec. 1970

Nov. 1971 83 p refs
(AD-733860; DDC-TAS-71-54-1) Avail: NTIS CSCL 14/2

The bibliography is a compilation of references on non-destructive testing, radiography, in a series of bibliographies on non-destructive testing. Citations were selected from entries processed into the Defense Documentation Center's data bank during the period from December 1963 through August 1971 and updates an earlier bibliography. References pertaining to radiographic techniques for use in inspection and evaluation of electronic parts, fatigue of plates and weldments in steels evaluation of metal fatigue, lack of penetration in aluminum fusion welds, small scale footing tests in wound material are included. Corporate author-monitoring agency, subject, title and report number indexes are included. GRA

N72-18272# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept. (SI).

MARK 7 ARRESTING ENGINE ALIGNMENT MEASURING SYSTEM AND PROCEDURES FOR ALIGNING CROSSHEAD TRACKS, SIDE RAILS, AND ENGINE CYLINDER

William A. Teasdale and Edward W. Williams 21 Oct. 1971 45 p
(AD-732445; NAEC-ENG-7689) Avail: NTIS CSCL 01/5

The report contains instructions for the use of Arresting Engine Alignment Measuring System, 61545-1 to determine alignment conditions of crosshead tracks, crosshead side rails, and engine cylinder bore on Mark 7 Arresting Engines, and outlines procedures necessary to correct any engine misalignment found to exist on those engines. Author (GRA)

N72-18273# Naval Air Engineering Center, Philadelphia, Pa. Engineering Dept.

MARK 7 ARRESTING GEAR PURCHASE CABLE DEVELOPMENT PROGRAM, JULY THROUGH DECEMBER 1970

Robert Black 24 Nov. 1971 126 p
(AD-733988; NAEC-ENG-7699) Avail: NTIS CSCL 13/9

The report summarizes wire rope testing conducted at the Naval Air Engineering Center on the various test machines during the indicated period. The effects of synthetic and fiber cores upon wire rope fatigue and interstrand notching are examined, as well as their relation to wire rope creep and its interrelation with fatigue. The influence of the number of wires in a round strand rope is investigated, and an analysis is performed to determine the effect of the loss of metallic area from abrasion upon rope strength for these constructions. Fatigue data is given for ropes with variable wire strength and also for two non-rotating wire ropes. Load-strain and load-torque data is presented for a number of 6 X 25 FWLLRS fiber and synthetic core ropes. Author (GRA)

N72-18274# RAND Corp., Santa Monica, Calif.

LUNOKHOD-1 SOVIET LUNAR SURFACE VECHICLE

Simon Kassel Sep. 1971 28 p
(Contract DAHC15-67-C-0141)
(AD-733960; R-802-ARPA) Avail: NTIS CSCL 22/1

Description of the delivery of the Soviet lunar exploration vehicle to the lunar surface in the Sea of Rains on 17 November 1970 by the Luna-17 mission, derived from literature published in the USSR between that date and May 1971. The fact that the Lunokhod-1 has thus far traveled nearly 10 km over rugged terrain and apparently continues to do so indicates success of the concept of a remote drone interacting directly with an unknown and hostile environment. Its sensory equipment comprises narrow-band television systems, mechanical probes, a chemical analysis system, X-ray and cosmic ray detectors, and assorted temperature and pressure gauges. Author (GRA)

12 FLUID MECHANICS

Includes boundary-layer flow; compressible flow; gas dynamics; hydrodynamics; and turbulence. For related information see also: 01 Aerodynamics; and 33 Thermodynamics and Combustion.

N72-18275*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A THIN-SHOCK-LAYER SOLUTION FOR NONEQUILIBRIUM, INVISCID HYPERSONIC FLOWS IN EARTH, MARTIAN, AND VENUSIAN ATMOSPHERES

William L. Grose Washington Dec. 1971 152 p refs
(NASA-TN-D-6529; L-7884) Avail: NTIS CSCL 20D

An approximate inverse solution is presented for the nonequilibrium flow in the inviscid shock layer about a vehicle in hypersonic flight. The method is based upon a thin-shock-layer approximation and has the advantage of being applicable to both subsonic and supersonic regions of the shock layer. The relative simplicity of the method makes it ideally suited for programming on a digital computer with a significant reduction in storage capacity and computing time required by other more exact methods. Comparison of nonequilibrium solutions for an air mixture obtained by the present method is made with solutions obtained by two other methods. Additional cases are presented for entry of spherical nose cones into representative Venusian and Martian atmospheres. A digital computer program written in FORTRAN language is presented that permits an arbitrary gas mixture to be employed in the solution. The effects of vibration, dissociation, recombination, electronic excitation, and ionization are included in the program. Author

N72-18276*# Scientific Translation Service, Santa Barbara, Calif.
ON THE OCCURRENCE OF LONGITUDINAL VORTICES IN TURBULENT BOUNDARY LAYERS AT CONCAVE WALLS
G. Sandmayr Washington NASA Feb. 1972 46 p refs Transl. into ENGLISH from "Euber das Auftreten von Laengswirbein in Turbulenten Grenzschichten an Konkaven Waenden" Deutsche Luft- und Raumfahrt, report DLR-FR-66-41 Jun. 1966 49 p
(Contract NASw-2035)
(NASA-TT-F-14120; DLR-FB-66-41) Avail: NTIS CSCL 20D

The existence of periodic longitudinal vortices in a turbulent boundary layer along a concave wall is investigated. In addition to the velocity profile, a profile of the eddy viscosity and the Reynolds number are given. The eigenvalue problem is approximately solved for neutral disturbances and for a particular boundary layer by Galerkin's method. The curve of critical curvature has a minimum for a certain wavelength of the disturbance. Within a certain range, it hardly changes with the Reynolds number. These results agree with previous experiments. Author

N72-18277# Rome Univ. (Italy). School of Aerospace Research.
CHARACTERISTICS AND LIMITATIONS OF THE GAS DYNAMIC SYSTEM HOT SHOT [CARATTERISTICHE E LIMITAZIONI DEGLI IMPIANTI GASDINAMICI "HOT SHOT"]
Carlo Buongiorno and Carlo Arduini Nov. 1970 17 p refs In ITALIAN
(Rept-33) Avail: NTIS

A description of the electric-arc-heated hypervelocity wind tunnel is presented. Associated apparatus and operating characteristics are also considered. Gas dynamic features are reviewed for nitrogen as the working gas. Transl. by K.P.D.

N72-18278# Rome Univ. (Italy). School of Aerospace Research.
CURRENT AND FUTURE DEVELOPMENT IN GAS DYNAMIC EXPERIMENTATION [PRESENTI E FUTURI SVILUPPI PER LA SPERIMENTAZIONE GASDINAMICA]
Carlo Buongiorno Dec. 1970 19 p refs In ITALIAN
(Rept-36) Avail: NTIS

Problems of very high Reynolds numbers and of high stagnation point are presented. Supersonic combustion is also considered. Transl. by K.P.D.

N72-18279# National Aerospace Lab., Tokyo (Japan).
INVESTIGATION OF AIR STREAM FROM COMBUSTOR LINER AIR ENTRY HOLES. 2: EXPERIMENTS WITH PAIRED AIR ENTRY HOLES AND A NUMERICAL ANALYSIS
Tetsuro Aiba and Masayuki Inoue Dec. 1970 41 p refs In JAPANESE; ENGLISH summary
(NAL-TR-227) Avail: NTIS

Investigation of the jets flowing from air entry holes of the combustor liner of a gas turbine was carried out using simplified models. Cold air was supplied through the air entry holes normally into the primary hot-gas flows. The mass flow of the primary hot-gas and issuing jets were measured, and the behavior of the air-jets was studied by the measurement of the temperature distribution of the gas mixture. The air-jets flowing from paired air entry holes were studied for two different configurations, one being parallel to and the other being normal to the primary flow. The effects of jet and gas stream velocities, gas temperature, together with the two different configurations were investigated. The discharge coefficient, the maximum penetration of the jets, the jet flow path, the mixing of the jets, and the temperature distribution across the jets were investigated. Empirical expressions which describe the characteristics of the jets under the conditions of the experiments were formulated. The experimental results showed that the penetration and the path of the jets flowing from the paired holes can be estimated from the modified empirical expressions obtained for the single air entry hole. The path and temperature variation of the jets were also numerically analyzed considering aerodynamic and thermal characteristics and entrainment. Author

N72-18280*# Massachusetts Univ., Amherst. Dept. of Mechanical and Aerospace Engineering.
FINITE DIFFERENCE SOLUTION TO THE THREE-DIMENSIONAL, INCOMPRESSIBLE THERMAL ENERGY BOUNDARY-LAYER EQUATION
J. A. Fillo and R. A. Burbank Sep. 1971 26 p refs
(Grant NGR-22-010-019)
(NASA-CR-125610; Rept-5/71) Avail: NTIS CSCL 20D

An implicit numerical method has been adopted for the solution to the three-dimensional, energy boundary-layer equation. The energy equation is written in terms of a dimensionless temperature function, the relative stagnation-enthalpy difference, and transformed by the introduction of a Blasius-type transformation of coordinates as well as dimensionless stream functions. The method is applied to the problem consisting of an infinite cylinder joined with its axis perpendicular to a thin, flat, heated plate. A Prandtl number equal to one is simply considered. Author

N72-18281# National Aerospace Lab., Tokyo (Japan).
A METHOD FOR THE FORMULATION OF LIFTING POTENTIAL FLOW PROBLEMS
1971 72 p refs In JAPANESE; ENGLISH summary
(NAL-TR-243) Avail: NTIS

A formulation of lifting potential flow problems was worked out in terms of a doublet distribution over the body surface and the trailing vortex sheet. It is shown that the velocity field due to surface distribution of doublets is equivalent to that due to surface distribution of vortices. This face was utilized to derive a non-singular expression of surface derivatives of potential due to a doublet distribution. In view of the significance of the Kutta condition in controlling the lifting flow field, the behavior of the potential and its derivatives was examined in the neighborhood of the trailing edge of a wing. Conditions on the strength of doublets were obtained for which flow velocity remains finite at the trailing edge. These conditions are incorporated in the final formulation of the lifting potential flow field. Author

N72-18282# National Research Council of Canada, Ottawa (Ontario).
THE MEASUREMENT OF THE VISCOSITY OF A FLUIDIZED LAYER WITH A PNEUMATIC TROUGH
W. Siemes and L. Hellmer 1971 33 p refs Transl. into ENGLISH from Chem. Eng. Sci. (England), no. 17, 1962 p 555-571 (German Language Doc.)
(NRC-TT-1505) Avail: NTIS

Viscosity measurements on fluidized layers were conducted by methods involving the introduction of a body into the layer, thus disturbing it. In the method suggested, the flow of the particles is determined in inclined troughs with a porous floor through which the fluidizing medium passes. The viscosity can then be calculated from the measured quantities. Author

N72-18283*# General Electric Co., Schenectady, N.Y. Research and Development Center.
SUBSONIC AND SUPERSONIC JET FLOW AND ACOUSTIC CHARACTERISTICS AND SUPERSONIC SUPPRESSORS
H. T. Nagamatsu, R. E. Sheer, Jr., and E. C. Bigelow 1972 105 p refs
(Contract NASw-1784)
(NASA-CR-125594; ITR-3) Avail: NTIS CSCL 20D

To study the similarities and differences between subsonic and supersonic jets, velocity and impact pressure fluctuations were determined along the axis over a jet Mach number range of 0.6 to 1.4 for a 2 in. diameter convergent nozzle and for a one inch diameter jet flow. Static pressure distribution fluctuations due to shear and turbulence in the jet flow for subsonic and supersonic jets were related to acoustic radiation to the far field. Also determined were flow and acoustic characteristics of a single shroud, and multiple shroud tube and shroud suppressors for supersonic and subsonic exhaust velocities. A compressor consisting of 191 tubes and 191 shrouds decreased the primary Mach number drastically for both jet Mach numbers of 1.4 and 0.7; rms impact and static pressure fluctuations on the axis were also reduced from values existing for an equivalent area single nozzle. G.G.

N72-18284*# Scientific Translation Service, Santa Barbara, Calif.

TRANSONIC FLOW PAST DUCTED BODIES OF REVOLUTION

Yu. B. Lifshits and O. S. Ryzhov Washington NASA Feb. 1972 7 p refs Transl. into ENGLISH from the book "O Transzvukovom Obtekanii Telvrashcheniya s Protokom" Moscow, Akad. Nauk SSSR, Izv., Mekhan. Zhidkosti i Gaza, Mar. - Apr. 1967 p 114-116

(Contract NASw-2035)

(NASA-TT-F-14118) Avail: NTIS CSCL 20D

Application of exact particular solutions in the form of polynomials in r (where r is a cylindrical coordinate) are given for the equations describing supersonic gas flows to the construction of a ducted body of revolution situated in a low-supersonic gas flow. The results indicate that in the solutions, shock waves attenuate asymptotically at r approaches infinity, as a result of which the solutions contain a rarefraction-wave envelope. Author

N72-18285# Grumman Aerospace Corp., Bethpage, N.Y. Research Dept.

SHOCK IMPINGEMENT CAUSED BY BOUNDARY LAYER SEPARATION AHEAD OF BLUNT FINS

Louis G. Kaufman, II, Robert H. Korkegi (ARL, Wright-Patterson AFB, Ohio), and Leo C. Morton (ARL Wright-Patterson AFB, Ohio) Feb. 1972 18 p refs

(RM-536) Avail: NTIS

High speed flow past a blunt protuberance on a surface results in a complex, three dimensional, inviscid-viscous interaction flow field. Tests were conducted to examine and obtain a better understanding of these interaction flow fields; the most recent tests included detailed flow field surveys for Mach 3 flows ahead of blunt fins on a flat plate surface with turbulent boundary layers. The separated flow was found to be unsteady; attributed to a pulsating, scavenging action of the horseshoe vortices. In addition to the peak pressures and heating rates at shock impingement on the fin leading edge, the plate experiences very large pressure and heating rates in the immediate vicinity of the fin root. Results from these tests and many other sources were analyzed to provide a better description of the interaction flow field. Author

N72-18286# National Center for Atmospheric Research, Boulder, Colo.

TWO UNEQUAL SPHERES IN SLOW VISCOUS LINEAR SHEAR FLOW

M. H. Davis Nov. 1971 44 p refs Sponsored by NSF

(NCAR-TN/STR-64) Avail: NTIS

A derivation using bispherical coordinates is presented for the forces and torques acting on two unequal stationary spheres with arbitrary orientation relative to a slow viscous flow field, which, in the absence of the spheres, would be a slow linear shear. Slow expansion or contraction of either sphere is also considered. The Stokes approximation to the hydrodynamic equations is assumed, with no slip on the boundaries. Computed force and torque coefficients are tabulated for a range of size ratios and relative separations. Several independent methods are derived for checking the consistency of the coefficients which, on the basis of these tests, are believed to be accurate to four or five significant figures. The results are related to a canonical triadic formulation. Author

N72-18287*# Scientific Translation Service, Santa Barbara, Calif.

THE DIFFERENTIAL EQUATION FOR THE TURBULENCE SCALE AND CALCULATION OF THE TURBULENT BOUNDARY LAYER ON A FLAT PLATE

G. S. Glushko Washington NASA Mar. 1972 13 p refs Transl. into ENGLISH from Proc. of All-Union Symp. on Probl. of Turbulent Flows Including Geophys. Appl., Kiev, 16-21 Jun. 1967

(Contract NASw-2035)

(NASA-TT-F-14169) Avail: NTIS CSCL 20D

A semiempirical differential equation describing the behavior of the turbulence scale was derived, and investigation of this equation in the case of flow in the turbulent boundary layer of a flat plate was conducted. The results of integration (for the case of a flat plate) of a system of equations describing the flow in a turbulent boundary layer and consisting of the Reynolds equation, the continuity equation, the energy equation, and the turbulence scale equation are presented. Author

N72-18288*# Scientific Translation Service, Santa Barbara, Calif.

CALCUATION OF THE PRESSURE DISTRIBUTION ON SLENDER AERODYNAMIC BODIES OF AN ARBITRARY HORIZONTAL AND CROSS SECTION DESIGN IN SUBSONIC AND SUPERSONIC FLOW

D. Hummel Washington NASA Mar 1972 36 p refs Transl. into ENGLISH from Proc. of 6th Intern. Council of the Aeron. Sci., Munich, 9-13 Sep. 1968, p 1-15

(Contract NASw-2035)

(NASA-TT-F-14167) Avail: NTIS CSCL 20D

A method is presented for the calculation of pressure distribution and the overall forces and moments on low aspect ratio bodies of finite thickness according to the slender body theory. The corresponding two-dimensional problem is solved in the cross section plane using the method of continuous distribution of vortices and sources which are located on the contour. Arbitrarily shaped cross sections with rounded edges as well as with sharp edges can be treated. The Mach number influence is determined by solving the complete linearized potential equation for the equivalent body of revolution for subsonic and supersonic speeds. The method is applied to the supersonic flow around conical bodies with arbitrary cross sections and to the subsonic and supersonic flow around a nonconical body. The results are compared with thin wing theory, the slender wing theory, and with experimental data. Author

N72-18289*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

HYPERSONIC RAREFIED FLOW OVER SHARP SLENDER CONES

Marvin I. Kussoy, David A. Stewart, and Clifford C. Hortsman Washington Mar. 1972 25 p refs

(NASA-TN-D-6689; A-4133) Avail: NTIS CSCL 20D

Drag, heat transfer, and number flux were measured on sharp cones in the near free, molecule flow regime, and the results were compared with available Monte Carlo calculations. In general, the calculations predicted the magnitude of the data; however, the heat transfer and drag increased with increasing Knudsen number at a faster rate than predicted. Also the drag coefficients measured for the slender cones at high Knudsen number were higher than predicted for free molecule flow. These disagreements between theory and experiment could possibly be attributed to the simplicity of the surface interaction laws assumed in the theory. Reynolds analogy factors obtained from the experimental measurements agreed with free-molecule values and also with that obtained by the Monte Carlo technique. Author

N72-18290*# Lockheed Missiles and Space Co., Sunnyvale, Calif. Fluid Mechanics Lab.

LOCALLY NONSIMILAR SOLUTIONS FOR RADIATING SHOCK LAYER ABOUT SMOOTH AXISYMMETRIC BODIES

Y. S. Chou Washington NASA Mar. 1972 59 p refs
(Contract NAS2-5749)
(NASA-CR-1989) Avail: NTIS CSCL 20D

Locally nonsimilar solutions for nongray radiating shock layers about smooth axisymmetric bodies have been obtained based on a newly developed approximate method. Good agreement is found with numerical solutions for inviscid cases (both radiating and nonradiating) and with series solutions for the radiating viscous case. For the inviscid case, the effect of radiative cooling is to destroy the entropy layer; at a distance far from the stagnation point, the shock layer is nearly isothermal. For the viscous case, the radiative wall flux approaches that of the inviscid case at a distance far downstream of the stagnation point. The method can also treat surface mass injection. Author

N72-18291# Von Karman Inst. for Fluid Dynamics, Rhode Saint-Genese (Belgium).

THE CALCULATION OF ADIABATIC LAMINAR BOUNDARY LAYER SHOCK WAVE INTERACTIONS IN AXI-SYMMETRIC FLOW. PART 2: HOLLOW CYLINDER FLARE BODIES WITH SPIN Final Scientific Report, 1 May 1970 - 30 Apr. 1971

Roger Leblanc, Harry P. Horton, and Jean J. Ginoux Jun. 1971 68 p refs
(Grant EOOAR-0065-69; AF Proj. 7064)
(AD-733164; VKI-TN-73-Pt-2; ARL-71-0199-Pt-2) Avail: NTIS CSCL 20/4

The report is concerned with developing a theoretical calculation method for the three-dimensional interaction between a laminar boundary layer and a shock wave, in the case when a constant transverse velocity is imposed, parallel to the shock plane. The phenomenon is studied on an adiabatic axi-symmetric body consisting of a hollow circular cylinder with a flare. The transverse velocity is generated by the rotation of the body about its axis of symmetry which is aligned in the main flow direction. The calculation procedure is derived from the two-dimensional integral method of Lees and Reeves. The required relationships between boundary layer integral properties are obtained from similar solutions of compressible axial flow on a rotating cylinder. GRA

N72-18292*# Rocketdyne, Canoga Park, Calif.

CORRELATION OF SPRAY DROPSIZE DISTRIBUTION AND INJECTOR VARIABLES

L. J. Zajac [1971] 302 p Supersedes R-7995
(Contract NAS7-726)
(NASA-CR-125674; R-8455; R-7995) Avail: NTIS HC$6.00/MF $0.95 CSCL 20D

The atomization characteristics of impinging stream rocket engine injection elements are studied to determine the effects of hydraulic and geometric parameters on the mass median drop size. The major conclusions are: (1) the velocity profile of impinging jets affects mean drop size, this effect is greater when the jets are laminar than when they are turbulent; (2) the drop size/injection velocity dependence for turbulent jet impingement differs from that obtained with non-turbulent jets; (3) the level of turbulence intensity does not affect mean drop size; (4) the impingement of disintegrated or nearly disintegrated jets substantially decreases atomization; and (5) even though an emulsion is formed when immiscible jets impinge, the level of emulsification is small. Author

N72-18293# Technion - Israel Inst. of Tech., Haifa. Dept. of Aeronautical Engineering.

BOUNDARY LAYERS ON AXISYMMETRIC BODIES AT SMALL ANGLE OF ATTACK

Oscar Pinkus Jun. 1971 38 p refs
(TAE-131) Avail: NTIS

Utilizing an expression given by Cooke and a previously obtained solution for yawed cones, an equation is derived for a three-dimensional equivalent radius for axisymmetric bodies at small angles of attack. This function, when used in any of the available axisymmetric boundary layer equations, yields corresponding solutions for yawed bodies. Expressions for the streamlines along which the boundary layer equations are to be integrated are also derived. The solutions are linked to the prevailing inviscid flow properties which are allowed to vary in an arbitrary manner along the generatrix, but in the circumferential direction are assumed to have the same functional variation as did the conical flow. The method yields longitudinal and circumferential boundary layer properties for both concave and convex configurations. Author

N72-18294# Weapons Research Establishment, Adelaide (Australia).

AN ENGINEERING DESIGN PROCEDURE FOR THE VELOCITY AND TEMPERATURE IN A SUPERSONIC FREE JET

G. Higginbottom Sep. 1971 34 p refs
(WRE-TN-480) Avail: NTIS

A semi-empirical design procedure which gives the velocity and temperature at any point in an axi-symmetrical supersonic air jet exhausting into still air is described. The procedure takes into account the nozzle outlet angle and the pressure and temperature of the exhausting jet relative to the environmental conditions; thus, it applies to contoured or conical nozzles, and underexpanded or overexpanded, hot or cold jets. Author

N72-18295# Bolt, Beranek, and Newman, Inc., Cambridge, Mass. Oceanology Dept.

MEAN VELOCITY PROFILE OF A THICK TURBULENT BOUNDARY LAYER ALONG A CIRCULAR CYLINDER

David M. Chase 21 Oct. 1971 30 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in Jul. 1972 Sponsored by ONR
Avail: NTIS CSCL 20D

Differing conjectures for the relation of the velocity profile of a turbulent boundary layer on a cylinder in axial flow without pressure gradient to the profile for a plane boundary are reviewed. Profiles are computed from the competing hypotheses and compared with previously measured profiles for a very slender cylinder. The derivative hypothesis, as well as the streamline hypothesis, yield poor agreement with measured results, whereas the Rao hypothesis conforms well. Extension to the cylindrical case of the classical argument based on overlapping inner and outer layers involving different similarity variables is noted to lead to the usual logarithmic profile with the variable $a\ln(1+y/a)$ of Rao's hypothesis (where a denotes cylinder radius) replacing the wall distance y. A rough comparison is appended of rates of growth of boundary layer and momentum thickness for planar and cylindrical flows. Author

N72-18296# Naval Ship Research and Development Center, Bethesda, Md.

MEASUREMENT OF THE BOUNDARY-LAYER PRESSURE FLUCTUATIONS ASSOCIATED WITH TURBULENT AIR FLOW IN A RIGID PIPE Final Report

Fred C. DeMetz and Donald W. Jorgensen Oct. 1971 30 p refs
(SF Proj. 35-452-007)
(AD-732402; NSRDC-3707) Avail: NTIS CSCL 20/4

The report gives the results of an experimental investigation of the pressure fluctuations associated with turbulent flow in a rigid pipe. Measurements were made of the power-spectral and cross-spectral densities of the pressure fluctuations on the pipe wall for fully developed turbulent air flow over a Reynolds number range of approximately 20 to 1. The variation in Reynolds number was achieved by variation in flow velocity. The spectral content of the pressure field was investigated for frequency components from 10 to 10,000 Hz. Special attention was given to obtaining spectral levels for the low-frequency components of the pressure field because power spectral density in the low wave-number region for turbulent pipe flow is still uncertain. GRA

N72-18297# Colorado Univ., Boulder.
RESEARCH IN INHOMOGEOUS TURBULENT WAKE FLOWS Final Progress Report
Joshua Menkes, Carlton Hindmar, and Sreedar-Rao 31 Aug. 1971 23 p ref
(Contract DAHC04-70-C-0040)
(AD-732908; AROD-9449-2-E) Avail: NTIS CSCL 20/4

The report considers a turbulent fluid moving uniformly with some average velocity through an inviscid medium, the boundary between the two fluids being quite sharp. It examines the response of the turbulent fluid to perturbations of the boundary and examines the response spectrum. The configuration of interest is the wake created by a sphere moving with a constant velocity through an incompressible medium. GRA

N72-18298# Naval Postgraduate School, Monterey, Calif.
EFFECTS OF POLYETHYLENE OXIDE SOLUTIONS ON THE PERFORMANCE OF A SMALL PROPELLER M.S. Thesis
Lee Herman Henderson Sep. 1971 68 p refs
(AD-733178) Avail: NTIS CSCL 20/4

The thrust and torque were measured and the efficiency calculated for a 14.6-cm diameter, two-bladed propeller in aqueous solutions of polyethylene oxide, WSR-301, with concentrations ranging from 0 to 75 wppm (weight parts per million). The full operating range fo the propeller was studied. For the propeller operating under heavily loaded conditions, the thrust decreases with increasing concentration while the torque passed through a minimum at 10 wppm. This resulted in an increase in efficiency of up to 10% at 10 wppm. For the propeller operating under lightly loaded conditions, the polymer had little effect on performance. If these results are applicable to full-sized propellers, drag-reducing polymers would not affect propeller performance significantly. Acoustic measurements were also made and they indicate that the polymer has no effect on the strength of the discrete components of the radiated propeller noise. Author (GRA)

N72-18299# Naval Postgraduate School, Monterey, Calif.
AN EXPERIMENTAL INVESTIGATION OF PULSATING SUBSONIC FLOW IN A CONICAL NOZZLE M.S. Thesis
Edward James Carlson Sep. 1971 53 p refs
(AD-733180) Avail: NTIS CSCL 20/4

Amplitude and phase relationships between sinusoidal pressure disturbances in the exit plane of a conical nozzle and mass flux response were experimentally determined for the subsonic flow of air in the nozzle. The experimental results were compared with values predicted by using the modified asymptotic Wentzel, Kramers, Brillouin method. Experimental measures were made with a constant temperature hot wire anemometer and a condenser microphone. Disturbance frequencies from 20 to 250 Hz were investigated for Mach numbers up to .34. GRA

N72-18300# Lehigh Univ., Bethlehem, Pa. Dept. of Mechanical Engineering and Mechanics.
AN EXPERIMENTAL STUDY OF THE SWITCHING DYNAMICS OF MONOSTABLE FLUID AMPLIFIERS
Mustafa R. Ozgu and Alan H. Stenning Oct. 1971 42 p refs
(Contract N00014-69-A-0417)
(AD-733077; TR-7) Avail: NTIS CSCL 20/4

The transient switching times of monostable fluid amplifiers were determined experimentally using a large model with a power nozzle width W of 3/4 in. Straight and convex attachment walls of equal length were tested. Water was used as the fluid and the flow field was made visible by generating hydrogen bubbles at the power nozzle exit. Three different Reynolds numbers based on W were used. The control slow was applied as a step, starting from an initial value of zero. Effects of attachment wall shape, opposite wall setback, control flow, load changes on the active output leg, Reynolds number and splitter position on the transient switching times were studied. It was desired to know whether the convex attachment wall provided better switching characteristics than the straight attachment wall. GRA

N72-18301# Massachusetts Inst. of Tech., Cambridge. Dept. of Mathematics.
FLUID DYNAMICS RESEARCH RELATED TO A RANGE OF FLUID FLOW PROBLEMS FROM SMALL FLUIDIC SYSTEMS TO LARGE ATMOSPHERIC CIRCULATIONS Final Scientific Report, 16 Sep. 1966 - 15 Sep. 1971
Harvey P. Greenspan Nov. 1971 12 p refs
(Contract F44620-67-C-0007; AF Proj. 9749)
(AD-733404; AFOSR-71-2995TR) Avail: NTIS CSCL 20/4

Research in rotating fluids concentrated on those topics which are of central importance to most areas of application. Boundary layer methods were used extensively to solve the basic equations governing the motion of a contained incompressible viscous fluid such as water in a simple controlled environment. Analytical procedures are pivoted about the inviscid linear solution, and a study of this reduced problem led to a fairly complete general theory. A general method was developed to examine the effects of dispersion and non-linearity for a variety of fluid flow configurations. A study was made of the way in which the spectral functions of random, spatially homogeneous, dispersive waves vary slowly in time due to weakly non-linear interactions. It was also shown that linear diffusion processes may be significantly altered by weak non-linear effects. New numerical methods were developed for the solution of hydrodynamics problems which give considerably more efficient and accurate simulations than those of known finite-difference methods. GRA

N72-18302# Naval Postgraduate School, Monterey, Calif.
TABLES OF EIGENVALUES AND EIGENFUNCTIONS OF THE ORR-SOMMERFELD EQUATION FOR PLANE POISEUILLE FLOWS
R. H. Gawain and W. H. Clark 10 Sep. 1971 185 p refs
(AD-733436; NPS-57GN71092A) Avail: NTIS CSCL 20/4

In the report the authors present a numerical technique for computing the eigenvalues and eigenfunctions of the Orr-Sommerfeld equation for infinitesimal disturbances in plane Poiseuille flows. For the case alpha = 1.0, R sub e = 6667 the eigenvalues, beta sub Nm, (n = 1,2,3,4 m = 1,2,...199) and eigenfunctions, phi sub nm(y), (n = 1,2,3,4 m = 1,2,...8) are presented in tabular and graphical form. In addition the function, chi sub nm(y), which is orthogonal to phi sub nm(y), over the interval -1 < or-y < - or - plus or minus 1 is tabulated. In a previous report (Gawain and Clark)1971) it was shown that these eigenfunctions can be extremely useful in describing certain aspects of the nonlinear mechanics of wave disturbances in plane Poiseuille flows. It is hoped that the present report will serve both as a complement to the previously mentioned report and as a useful reference for similar future investigations. Author (GRA)

N72-18303# Ballistic Research Labs., Aberdeen Proving Ground, Md.
THE DYNAMICAL EFFECT OF INERTIAL WAVES ON THE FREE FLIGHT MOTION OF A BODY CONTAINING SEVERAL ECCENTRICALLY LOCATED, LIQUID FILLED CYLINDERS
W. E. Scott Sep. 1971 26 p refs
(AD-733365; BRL-1551) Avail: NTIS CSCL 19/4

A theoretical analysis is made of the effect described in the title. It is shown that both the eigen frequencies of the inertial waves and the moment produced by the inertial wave pressure distribution are independent of the location of the off-axis cylinder. Hence, one can use Stewartson's tables computed for a centrally located cylinder to calculate the frequencies and residues for an eccentrically located cylinder. Author (GRA)

N72-18304# Denver Research Inst., Colo. Div. of Mathematical Sciences.
FOURIER ANALYSIS OF INITIAL VALUE PROBLEMS FOR

SURFACE AND INTERNAL WAVES, 2

Norman Bleistein, J. Cohen, and D. Hector 14 Mar. 1972 49 p refs
(Grant AF-AFOSR-1923-70; AF Proj. 9749)
(AD-733395; MS-R-7206; AFOSR-71-3006TR) Avail: NTIS CSCL 20/4

Different types of initial value problems and one moving source problem are considered for a fluid of constant depth and constant Brunt-Vaisala frequency. Two alternate Fourier representations are developed, one appropriate for analysis in terms of transverse propagation of modes, the other appropriate for analysis in terms of three dimensional propagation with reflections from upper and lower surfaces. Asymptotic expansions of these representations are then derived, these representations taking different forms depending upon the nature of the initial data or source. Author (GRA)

N72-18305# California Univ., Los Angeles. School of Engineering and Applied Science.

SHOCK WAVE AT OCEAN SURFACE: BIBLIOGRAPHY OF TECHNICAL REPORTS AND PAPERS PUBLISHED IN SCIENTIFIC JOURNALS DURING REPORTING PERIOD 1 JULY 1970 - 30 SEPTEMBER 1971 Annual Report

Robert Collins 30 Sep. 1971 73 p refs
(Contract N00014-69-A-0200-4013; NR Proj. 089-055)
(AD-733779; UCLA-ENG-7173) Avail: NTIS CSCL 20/4

The annual report describes recent results of an analytic study of the diffraction of a normal shock wave at ocean interfaces including interfaces resulting from stratification due to density, temperature, and pressure variations. Solutions for shock propagation in non-uniform media have been obtained in both linearized and general nonlinear formulations. The results have been reported in several journal publications and presented at a number of international colloquia during the reporting period July 1, 1970 to September 30, 1971. Author (GRA)

N72-18306# Naval Ordnance Lab., White Oak, Md.

A COLD FLOW FIELD EXPERIMENTAL STUDY ASSOCIATED WITH A TWO-DIMENSIONAL MULTIPLE NOZZLE

Jerry L. Wagner 1 Jul. 1971 93 p refs
(AD-731677; NOLTR-71-78) Avail: NTIS CSCL 14/2

A cold flow-field study of a rapid expansion, Mach 4.73, two-dimensional multiple nozzle array has been carried out in the hypersonic wind tunnel. The nozzles are of the type used in a gas dynamic laser where the quality of the downstream flow field is important. The report examines the uniformity of the flow field in such a multiple nozzle array. Tests were conducted at supply conditions of 45 psia and 540 deg R. Pitot pressure, static pressure, and total temperature were measured along the axial, vertical, and horizontal centerlines within the nozzle and 21 nozzle exit heights downstream. Shadowgraph pictures provided qualitative flow field observations. The shock structure consisted of sidewall shocks, nozzle trailing edge shocks, and nozzle throat shocks. Viscous phenomena consisted of the boundary layers on the sidewalls and contoured walls, as well as the turbulent wakes caused by the trailing edges of the center nozzle blades. Mach number, static temperature, static density, and velocity profiles are presented. This flowfield information is useful to the prediction of the degradation of beam quality resulting from the non-homogeneity of a gas-dynamic-laser flowfield. GRA

N72-18307# Virginia Polytechnic Inst., Blacksburg. Dept. of Engineering Mechanics.

A NUMERICAL STUDY OF SEPARATING SUPERSONIC LAMINAR BOUNDARY-LAYERS

G. D. Senechal and M. J. Werle 27 Sep. 1971 74 p refs
(Contract N00014-70-C-0024; NR Proj. 061-180)
(AD-733974; VPI-E-71-21) Avail: NTIS CSCL 20/4

A numerical study has been made of the nature of the solution to the supersonic boundary-layer equations when the flow separates from the surface. To this end, implicit finite difference solutions to the governing equations are obtained for linearly and quadratically retarded flows over flat plates for a Mach number range of 2 to 15. Both extremely hot and cold wall conditions are considered. Also, solutions for flow on a compression ramp are obtained with and without including the boundary layer's free interaction with the local freestream. The results of this study indicate that non-interacting flows are singular at separation and that free interaction effects reduce singularity. An alternate means of numerically smearing out the singularity and proceeding past separation is also presented. GRA

N72-18308# Naval Underwater Systems Center, Newport, R.I.

WAVE-INDUCED REYNOLDS STRESS IN TURBULENT SHEAR LAYER STABILITY

Roy C. Elswick Sep. 1971 88 p refs
(AD-733968; NUSC-4189) Avail: NTIS CSCL 20/4

Disturbance equations relevant to linear stability of a turbulent shear layer are studied in the presence of a background field of locally homogeneous turbulence. Coupled momentum and Reynolds stress equations are closed by means of an ad hoc assumption for the intercomponent transfer of turbulent energy embodied in the pressure-velocity correlation. For solutions propagating obliquely in the plane of parallel mean flow, the three-dimensional problem is transformed to two dimensions. Eigenvalues of wavenumber, phase speed, and turbulent Reynolds number parameter along the neutral curve are computed for large disturbances and weak background turbulence. Author (GRA)

N72-18309# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.

THE EVOLUTION OF A SELF-EXCITED OSCILLATION IN A NONLINEAR CONTINUOUS SYSTEM

Michael F. Mortell and Brian R. Seymour Aug. 1971 33 p refs Prepared in cooperation with New York Univ., N. Y.
(Contract DAAD05-69-C-0053; Proj. Themis-65)
(AD-733929; CAM-110-19; BRL-CR-48) Avail: NTIS CSCL 20/4

A gas filled tube has a pressure sensitive heat source at the center, while energy is allowed to radiate from the ends. For a sufficiently large feedback coefficient, the system is linearly unstable. Within the nonlinear theory, the self-excited oscillation initially grows until a shock forms. The shock acts as a dissipative mechanism so that a balance is achieved and ultimately a time periodic state is reached. The small amplitude disturbance in the pipe is represented as the superposition of two simple waves traveling in opposite directions, and without interaction. Based on this representation the problem reduces to solving a nonlinear difference equation. Author (GRA)

13 GEOPHYSICS

Includes aeronomy; upper and lower atmosphere studies; oceanography; cartography; and geodesy. For related information see also: 20 Meteorology; 29 Space Radiation; and 30 Space Sciences.

N72-18310 European Space Research Organization, Paris (France).

ESRO CONSULTANTS REPORT ON THE REQUIREMENTS AND RECOMMENDATIONS FOR A EUROPEAN PROGRAMME IN THE REMOTE SENSING OF EARTH RESOURCES

Oct. 1971 89 p refs Partly in FRENCH and partly in ENGLISH
Avail: Issuing Activity

Geoscientists from ESRO attended the International Workshop on Earth Resources Survey Systems and the Seventh International Symposium on Remote Sensing of the Environment. The consultants' reports from European countries are presented and include: description of their national program in the remote sensing of earth resources; the reasons and needs for a

European program; and recommendations on the role ESRO should adopt in a European program. For individual titles, see N72-18311 through N72-18318.

N72-18311 European Atomic Energy Community, Ispra (Italy).

NECESSITY AND IMPORTANCE OF A EUROPEAN PROGRAM FOR REMOTE SENSING [LA NECESSITE ET L'IMPORTANCE D'UN PROGRAMME EUROPEEN DE TELEDETECTION]

L. VanWambeke *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 1-17 refs In FRENCH (See N72-18310 09-13)
(CCR/29/71-F) Avail: Issuing Activity

The need for coordination of European programs for remote sensing of earth resources is emphasized. An experimental aircraft and a European satellite for surveying the earth resources of developing countries are considered. A role for ESRO in the European earth resources remote sensing program is suggested. ESRO

N72-18312 Ludwig-Maximilians-Universitat, Munich (West Germany). Dept. of Photogeology and Remote Sensing.

NECESSITY AND IMPORTANCE OF AN EARTH RESOURCES SATELLITE PROGRAM IN EUROPE

J. Bodechtel *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 18-35 refs (See N72-18310 09-13)
Avail: Issuing Activity

Emphasis is placed on the increasing necessity of using satellites rather than aircraft in earth resources remote sensing. Some potential applications of earth resources satellites are mentioned. A proposal is made for a European program applying photointerpretation. The role of ESRO in the European earth resources remote sensing program is considered. Earth resources activities and available equipment in Germany are mentioned. ESRO

N72-18313 Centre National d'Etudes Spatiales, Paris (France).

REMOTE SENSING AND ECOLOGY [TELED ET ECTION ET ECOGRAPHIE]

A. Alouges and C. Rossetti *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 36-47 In FRENCH (See N72-18310 09-13)
Avail: Issuing Activity

The use of remote techniques for the sensing of the earth's surface is introduced. Some earth resources remote sensors available in France are reviewed, as well as the experiments using instruments onboard aircraft or balloons. The possible role of ESRO in a European program for the realization of a station receiving and pre-processing US meteorological satellite images is considered. ESRO

N72-18314 Milan Univ. (Italy). Dept. of Terrestrial Physics.

REMOTE SENSING TECHNIQUES AND THEIR IMPORTANCE IN THE EARTH RESOURCES PROGRAMME AND THE STUDY OF THE ENVIRONMENT

R. Cassinis *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 48-57 (See N72-18310 09-13)
Avail: Issuing Activity

Remote sensing principles and equipment are reviewed. The Italian program on earth resources remote sensing is briefly outlined. The need for a European program including an earth resources survey aircraft as a preliminary step to either a European earth resources technology satellite or to European participation in NASA-manned or unmanned space flights is reported. Possible fields of application are considered. ESRO

N72-18315 Netherlands Interdepartmental Working Group on the Application of Remote Sensing, Delft.

REMOTE SENSING APPLICATION RESEARCH PROGRAMME IN THE NETHERLANDS

Eric R. Bosman and David Eckhart *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 58-64 (See N72-18310 09-13)
Avail: Issuing Activity

The history of the national earth resources remote sensing program in the Netherlands is outlined. The NIWARS (Netherlands Interdepartmental Working-Committee for the Applications of Remote Sensing) program, structure, and organization are reviewed. ESRO

N72-18316 Teleplan A.B., Solna (Sweden).

SOME COMMENTS ON A POSSIBLE ESRO EARTH RESOURCES PROGRAM

Gunnar Hoppe and Stefan Zenker *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 65-68 ref (See N72-18310 09-13)
Avail: Issuing Activity

Remote sensing activities in Sweden are outlined. Suggestions are made for establishing a European earth resources remote sensing program. ESRO

N72-18317 Zurich Univ. (Switzerland). Dept. of Geography.

[FUTURE RESEARCH IN REMOTE SENSING IN SWITZERLAND]

Harold Haefner *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 69-76 (See N72-18310 09-13)
Avail: Issuing Activity

American and Swiss earth resources programs are described and compared. A proposal is made for a European earth resources remote sensing program including an experimental aircraft. The ultimate goal of a European earth resources satellite is considered. ESRO

N72-18318 Royal Aircraft Establishment, Farnborough (England). Space Dept.

EARTH RESOURCES SENSING TECHNOLOGY IN EUROPE

S. L. Entres *In* ESRO Consultants Report on the Requirements and Recommendations for a European Programme in the Remote Sensing of Earth Resources Oct. 1971 p 77-85 (See N72-18310 09-13)
Avail: Issuing Activity

American and European earth resources programs and remote sensing techniques are considered. European needs and the role of ESRO as coordinator in a European program are emphasized. The ways and means by which ESRO could be organized and equipped are discussed in order to: give technological assistance to national investigations; carry out an approved research and development program; and harmonize among European investigators, as well as with the US, data acquisition and analysis techniques for improved efficiency of the investigators. ESRO

N72-18319# Natural Environment Research Council, London (England).

A REVIEW OF RECENT INVESTIGATIONS OF THE SEA BED ON THE CONTINENTAL MARGIN AROUND THE BRITISH ISLES

Oct. 1971 34 p refs
(Publ-c-No-5) Avail: NTIS

Geophysical, geological and sedimentological surveys on the continental shelf are updated. Three maps were used, and projects were classified as geophysical, geological (bedrock), and geological (superficial deposits). Several projects cover two or three of the divisions and classification in these cases is based where possible on the major objective of the research. Author

N72-18320# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.

A STUDY OF POLAR MOTION M.S. Thesis

Antonios Terpos 1971 287 p refs In GREEK
Avail: NTIS

Field measurements relative to polar motion and a model of the earth that will give the expected results are presented. The changes in the axis of rotation as a result of precession, nutation, and wobble are discussed, and their causes are investigated. Methods of observation and the establishment of a general coordinate system as a master reference for latitude measurements are described. Initial data from five ILS stations are included, and the methods used by the Central Bureau in analyzing the data are outlined. Possible errors in azimuth and inclination data are treated, along with correction methods, emphasizing the chain method. The model of the earth is based on the earth's ability to react to the forces of nature; the earth is considered as essentially stable and solid. Theories treating the earth as an elastic body are also discussed. Tensor analysis is employed throughout. Author

N72-18321# Institut d'Aeronomie Spatiale de Belgique, Brussels.

OPTIC MANIFESTATIONS OF METEORIC AEROSOLS

M. Fehrenbach, D. Frimout, F. Link, and C. Lippens 1971 11 p refs In FRENCH, ENGLISH summary
(Aeronomica-Acta-A-87) Avail: NTIS

The photometric measurements of stratospheric balloons demonstrate the influence of the Orionids on the crepuscular sky. Author

N72-18322# Academy of Sciences (USSR), Moscow. Inst. for Space Research.

ON THE DYNAMIC FIELD ALIGNED CURRENTS IN THE MAGNETOSPHERE

V. A. Gudkova, L. M. Zeleny, and V. A. Liperovsky 1971 24 p refs In RUSSIAN; ENGLISH summary
(NP-83) Avail: NTIS

The generation of the turbulence is associated with currents and electric fields along lines of force. Anomalous dissipation of field-signal currents, caused by turbulence, is the mechanism of gradual heating of plasma. The study of damping of short-time magnetic field variations, corresponding to MHD-waves in the magnetosphere, may be used as a method of investigation of above mentioned phenomena. As calculations show, the damping must decrease with an increase of temperature; and, consequently, with the time, an analysis of magnetograms confirm that the damping of geomagnetic pulsations in the presence of bays really has such a tendency. Author

N72-18323# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.

DETERMINATION OF THE COEFFICIENT OF TERRESTRIAL REFRACTION IN THE AREA OF THESSALONIKI, VOLUME 1 AND VOLUME 2 M.S. Thesis

L. Vazouros, M. Demetriades, G. Kotsiones, and P. Spathakes [1969] 507 p In GREEK 2 Vol.
Avail: NTIS HC $6.00/MF $0.95

Methods of determining the coefficient of terrestrial refraction K and the manner in which it changes are studied. The first method is based on the principle that the angle of elevation of a point relative to a second point changes constantly and depends directly on K. In another method, the difference in elevation between two points and the horizontal distance between them are used. The curvature of the earth and refraction are discussed as factors affecting the value of K. The determination of the horizontal distance between the two points is covered. The instruments Ni-2 Zeiss and Wild T3 are described in detail along with their use. The coefficient is also considered as a function of temperature, pressure, and humidity. Data collected in the field are used to find the value of K a Thessaloniki. Tables are given of all field data, calculations, corrections, and error analysis. Author

N72-18324*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

REMOTE MEASUREMENT OF POLLUTION

Washington 1971 261 p refs
(NASA-SP-285) Avail: NTIS CSCL 14B

A summary of the major conclusions and recommendations developed by the panels on gaseous air pollution, water pollution, and particulate air pollution is presented. It becomes evident that many of the trace gases are amenable to remote sensing; that certain water pollutants can be measured by remote techniques, but their number is limited; and that a similar approach to the remote measurement of specific particulate pollutants will follow only after understanding of their physical, chemical, and radiative properties is improved. It is also clear that remote sensing can provide essential information in all three categories that can not be obtained by any other means. Author

N72-18325*# National Aeronautics and Space Administration, Washington, D.C.

TOWARD AN UNDERSTANDING OF THE LAWS GOVERNING THE DEVELOPMENT OF THE EARTH'S CRUST AND THE GEOTHERMAL FIELDS OF THE LITHOSPHERE

N. S. Boganik Feb. 1972 83 p refs Transl. into ENGLISH of the book "K Poznaniyu Zakonomernostey Razvitiya Zemnoy Kory i Geotermalnykh Poley Stratisfery" Moscow, Nauka Press, 1970
(NASA-TT-F-699) Avail: NTIS CSCL 08E

The problems are dealt with relating to the progressive development of the processes involved in the formation of the earth's crust. The causes and factors affecting the emergence of new laws during their development, processes of radioactive decay, and their significance in the evolution of terrestrial matter and the origination of geothermal fields are considered. Author

N72-18326*# Aerospace Corp., El Segundo, Calif. Space Physics Lab.

QUIET-TIME OBSERVATION OF A COHERENT COMPRESSIONAL Pc-4 MICROPULSATION AT SYNCHRONOUS ALTITUDE

George A. Paulikas, Michael Schulz, J. N. Barfield (Calif. Univ., Los Angeles), L. J. Lanzerotti (Bell Telephone Labs., Murray Hill, N. J.), and C. G. Maclennan (Bell Telephone Labs., Murray Hill, N. J.) Apr. 1971 21 p refs
(Grant NGL-05-007-004; Contract F04701-70-C-0059)
(NASA-CR-125612; SPL-1210) Avail: NTIS CSCL 03C

During a magnetically quiet interval the magnetic-field intensity and energetic electron fluxes at ATS 1 exhibited coherent modulations having a frequency of 33.8 cph and a duration of approximately 40 oscillations. The electron fluxes and the magnetic field oscillated in phase. The field perturbation reached 8 jamma (peak to peak) in the direction of the unperturbed geomagnetic field. The transverse component of the field perturbation was practically zero. The characteristics of the observed oscillations appear compatible with those of a compressional excitation of the outer magnetosphere. The substantially radial normal mode is perhaps driven by a bounce-resonant interaction with the 15-keV protons that populate the quiet-day ring current. Author

N72-18327# Institut d'Aeronomie Spatiale de Belgique, Brussels.

EFFECT OF ESCAPING PHOTOELECTRONS IN A POLAR EXOSPHERIC MODEL

J. Lemaire Jun. 1971 17 p refs
(Aeronomica-Acta-A-94) Avail: NTIS

The effect of a photoelectron escape flux on a polar wind model is discussed. It is shown that the additional electric drag force due to the escaping photoelectrons can accelerate the ions to higher velocities if the photoelectron flux is larger than the escape flux of the thermal electrons. Furthermore, it is shown that, even if the number density of the photoelectrons remains small compared to the number density of the thermal electrons, their kinetic pressure becomes important at very high altitudes. As a consequence a positive gradient in the electron temperature can be expected in the sunlit polar cap upper region. Author

N72-18328*# Hughes Research Labs., Malibu, Calif. Exploratory Studies Dept.
GRAVITY GRADIENT STUDY Final Report
C. C. Bell Jul. 1971 69 p refs
(Contract NAS8-24788)
(NASA-CR-123489) Avail: NTIS CSCL 08N

The results of the noise and drift test, and the comparison of the experimental simulation tests with the theoretical predictions, confirm that the rotating gravity gradiometer is capable of extracting information about mascon distributions from lunar orbit, and that the sensitivity of the sensor is adequate for lunar orbital selenodesy. The experimental work also verified analytical and computer models for the directional and time response of the sensor. Author

N72-18329*# Scientific Translation Service, Santa Barbara, Calif.
THE PROTECTIVE EFFECT OF LONG RANGE LIGHTNING RODS AND THE FREQUENCY OF LIGHTNING STROKES IN SEVERAL LARGE CITIES
B. Walter Washington NASA Feb. 1972 11 p refs Transl. into ENGLISH of "Ueber die Schutzwirkung von Fernblitzableitern und die Blitzschlag-haeuefigkeit in einigen Grossstaedten" Duetsche oeffentlica-rechliche Versicher., 1935 p 290-294
(Contract NASw-2035)
(NASA-TT-F-14163) Avail: NTIS CSCL 04A

The protection given by lightning rods on tall buildings to the surrounding areas was investigated. The lightning susceptibilities of several German cities and of areas within the cities were determined based on insurance statistics. The data are felt to support the hypothesis that the lightning rod (height H) protects buildings (height h) within a radius equal to (H - h), but its protective range does not extend to 2(H - h). N.E.N.

N72-18330# Institut d'Aeronomie Spatiale de Belgique, Brussels.
O(PLUS), H(PLUS), AND He(PLUS) ION DISTRIBUTIONS IN A NEW POLAR WIND MODEL
J. Lemaire 1971 26 p refs
(Aeronomica-Acta-A-93) Avail: NTIS

It is shown how the hydrodynamic solutions of the polar wind can be fitted to the kinetic solutions applicable to the upper ionospheric polar regions where the Coulomb collisions are negligible. The bulk velocity and density distribution of the O(+), H(+), and He(+) are determined for boundary conditions deduced from the OGO 2 observations by Taylor et al. (1969), and for unequal ion and electron temperatures. The results are compared to the observations of Hoffman (1971) (Explorer 31) near 3000 km altitude. Author

N72-18331*# California Univ., Berkeley. Forestry Remote Sensing Lab.
MONITORING EARTH RESOURCES FROM AIRCRAFT AND SPACECRAFT
Robert N. Colwell et al Washington NASA 1971 203 p refs Sponsored by NASA Original contains color illustrations
(NASA-SP-275; LC-73-170325) Avail: NTIS; SOD $4.00 CSCL 08G

An experiment that sought to determine the extent to which earth resources might be monitored by means of periodic inventories made with the aid of aerial and Apollo 9 photography is described. Several geographic locations were investigated with special emphasis on farm crops and vegetation. The value of such results to resource management is also examined. For individual titles, see N72-18332 through N72-18342.

N72-18332*# California Univ., Berkeley.
MONITORING EARTH RESOURCES FROM AIRCRAFT AND SPACECRAFT: INTRODUCTION
R. N. Colwell *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 1-7 refs (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 08G

Data from the Apollo 9 photographs, taken by the Hasselblad camera, infrared Ektachrome color black and white film, are discussed. The black and white three camera system photographs are compared to those of the infrared color system. In addition to producing the sharpest photographs, the black and white system can take photographs on three different wavelengths simultaneously, has uniform color balance, and its sequential photographs can be color combined and enhanced. The infrared system has no color uniformity, shows sharp vegetation features but other earth features are unclear, and the film is difficult to process in the distinct features needed to assign color codes to various earth resources. The sequential photographs of earth resources taken by high altitude aircraft are also discussed. E.H.W.

N72-18333*# California Univ., Berkeley.
ADDITIVE-COLOR IMAGE ENHANCEMENTS: TECHNIQUES AND EQUIPMENT c23
Jerry D. Lent *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 9-14 ref (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 20F

Some of the techniques and equipment used to extract information from multiband images through additive color image enhancement, are cited. Detailed descriptions are given of optical, electrical, multispectral, and combinations of electrical and optical systems. The limitations and advantages of such systems are discussed. E.H.W.

N72-18334*# California Univ., Berkeley.
ANALYSIS OF EARTH RESOURCES IN THE PHOENIX, ARIZONA, AREA
David M. Carneggie, Lawrence R. Pettinger, and Claire M. Hay *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 15-64 refs Original contains color illustrations (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 08G

An analysis of earth resources around Phoenix, Arizona, measured by Apollo 9 photographs and sequential photographs from high altitude aircraft is presented. The analysis includes data for agriculture, range, geologic, hydrologic, and cultural resources. Major efforts were made to determine the usefulness and/or limitations of such photography for evaluating and monitoring earth resources. E.H.W.

N72-18335*# California Univ., Berkeley.
ANALYSIS OF AGRICULTURAL RESOURCES IN THE IMPERIAL VALLEY, CALIFORNIA
Randolph R. Thaman and Leslie W. Senger *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 65-92 refs Original contains color illustrations (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 02D

Differentiating individual crops within an agricultural area, based on high altitude and Apollo 9 photography, is discussed. The Imperial Valley, California area was used for the study. The primary objective of the program was to determine the feasibility of making broad crop inventories based on such photography. Results indicate spacecraft photographs can be used but are less accurate than high altitude photographs because of poor color and tonal differences. High altitude photography has the disadvantage of being dependent on weather conditions for its success. E.H.W.

N72-18336*# Oregon State Univ., Corvallis.
A PRELIMINARY VEGETATIONAL RESOURCE INVENTORY AND SYMBOLIC-LEGEND SYSTEM FOR THE TUCSON-WILLCOX-FORT HUACHUCA TRIANGLE OF ARIZONA
Charles E. Poulton, Barry J. Schrumpf, and Edmundo Garcia-Moya *In* Calif. Univ. Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 93-109 (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 02F

The methods used for mapping natural vegetation and related physiographic features of the Tucson-Willcox-Fort Huachuca triangle of Arizona, are discussed. The procedures and mapping examples are based on cartographic principles and symbolic legend concepts developed in previous programs. Aerial and spaceborne photography are also used. E.H.W.

N72-18337*# California Univ., Berkeley.
EVALUATION OF WILDLAND RESOURCES OF THE NASA BUCKS LAKE TEST SITE
Andrew S. Benson *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 111-115 refs Original contains color illustrations (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 08G

Three types of high altitude photography, Infrared Ektachrome, Infrared Aerographic with Wratten 89B filter (IR-89B), and Panatomic-X with a Wratten 25A filter (Pan-25A), were used to analyze wildland resources around Buck's Lake test site. Based on these data efforts were made to (1) map types of ground cover according to brush or dry-site wood, medium to high density conifer, low density conifer, rock or bare soil, meadow or riparian hardwood, and water; (2) monitor changes in ground cover with sequential coverage; and (3) select primary sample units for more detailed multistage sampling. Results show Infrared Ektachrome to be most satisfactory for determining ground cover boundaries, while Pan-25A was satisfactory for determining other cover types. Except for determining bodies of water, water courses, and riparian hardwoods, IR-89B proved unsatisfactory for overall ground cover typing. It was concluded that more study is needed before the usefulness of high altitude photography as an inventory procedure of wildland resources can be accessed. E.H.W.

N72-18338*# California Univ., Berkeley.
A LAND-USE CLASSIFICATION SYSTEM FROM APOLLO 9 PHOTOGRAPHS FOR THE MISSISSIPPI-LOUISIANA AREA
Robin I. Welch, Lawrence R. Pettinger, and Edwin H. Roberts *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 117-127 Original contains color illustrations (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 02F

The photorecognition potential of photographs taken of the Mississippi Louisiana area by Apollo 9 is investigated. Studies show the following features were recognized: (1) deciduous forest, (2) pine forest, (3) mixed deciduous and pine forest, (4) cultivated land including bare ground, vegetation covered ground, and fallow ground, (5) open bodies of water (lakes, reservoirs, etc.) (6) rivers and canals, (7) urban and industrial areas, and (8) major roads. E.H.W.

N72-18339*# California Univ., Berkeley.
MULTISTAGE SAMPLING OF EARTH RESOURCES WITH AERIAL AND SPACE PHOTOGRAPHY c14
Philip G. Langley *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 129-141 refs (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 14E

The correlation of ground data with aerial and spaceborne photography to sample or catalog earth resources of large land areas is discussed. The effort was centered around an attempt to provide an inventory of natural resources, monitor crop development, locate new resource possibilities, and establish optimal distribution patterns. The variable probability sampling theory was used in the study. E.H.W.

N72-18340*# California Univ., Berkeley.
THE USE OF SMALL-SCALE AERIAL PHOTOGRAPHY IN A REGIONAL AGRICULTURAL SURVEY c14
William C. Draeger and A. S. Benson *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 143-149 refs (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 14E

Photointerpretation tests of barley and wheat around Maricopa County, Arizona are made to: (1) determine the relative value of small scale aerial photography and Apollo 9 space photography for crop inventory, and (2) evaluate the usefulness of multidate and multiband photography of such surveys. Survey results are given in tabular form. E.H.W.

N72-18341*# California Univ., Berkeley.
SIGNIFICANCE OF THE RESULTS OBTAINED IN RELATION TO USER REQUIREMENTS
Robert N. Colwell *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 151-165 refs (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 08G

The significance of results obtained on earth resources using sequential aerial and Apollo 9 photography is examined. Conclusions show: (1) user requirements for such information is great, (2) other types of inventory data are needed beyond those investigated, and (3) acquisition of additional information that is required in earth resources survey can be facilitated through proper use of these types of photography. E.H.W.

N72-18342*# California Univ., Berkeley.
MONITORING EARTH RESOURCES FROM AIRCRAFT AND SPACECRAFT: SUMMARY AND CONCLUSIONS
Robert N. Colwell *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 167-170 (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 08G

A summary of the experimental results obtained both quantitatively and qualitatively during earth resources monitoring is presented. Also given are the conclusions as to advantages, limitations, and overall feasibility of monitoring earth resources with the aid of aerial and space photography. E.H.W.

N72-18343*# Bellcomm, Inc., Washington, D.C.
THE BRIGHTNESS TEMPERATURE OF THE AIR-SEA INTERFACE AT MICROWAVE FREQUENCIES
C. C. H. Tang 21 Jan. 1972 32 p refs
(Contract NASw-417)
(NASA-CR-125672; TM-72-1011-1) Avail: NTIS CSCL 08C

Available results of observation have shown that at nadir the brightness temperature of the sea surface at 19.35 GHz increases linearly with increasing wind speed. The computational results of the modified theoretical model presented are in good agreement with the measurement results both at nadir and other angles. The model depicts that, for a fully developed sea driven by the wind with speed above 5 m/sec, the air in the transitional zone immediately above the air-sea interface is mixed with sea water droplets from bursting air bubbles. The droplet concentration has a profile tapering off to zero at a certain height. The dielectric constant of the inhomogeneous droplet profile is thus both a function of the height above the interface and the wind speed. Both the inhomogeneity effect and the possible attenuation effect of the droplet concentration have been considered. Author

N72-18344*# Bellcomm, Inc., Washington, D.C.
CAPABILITIES OF THE SKYLAB-A SPECTROMETER (S191) FOR REMOTE SENSING OF SURFACE TARGETS IN THE THERMAL-INFRARED SPECTRAL REGION
R. W. Newsome, Jr. 20 Jan. 1972 66 p refs
(Contract NASw-417)
(NASA-CR-125671; TM-72-1011-2) Avail: NTIS CSCL 08G

The effects of some of the factors which fundamentally limit the amount of information which can be deduced from spectrometer (S191) measurements, made from the orbital altitude of Skylab-A, of the thermal-infrared power radiated into space from typical surface targets are discussed. The particular significance of this spectral region is that the power radiated at night is comparable in intensity to that in daylight. Calculations were made which simulate the quality of spectrometer data that could be expected from spectral measurements made in space, of the thermal-infrared radiation emitted from typical rocks on the surface. The results indicate that the reststrahlen structure in these spectra is not distinctive enough to permit reliable identification of the rocks. This conclusion is confirmed by relevant data which have already been obtained from aircraft and spacecraft. Author

N72-18345*# South Dakota State Univ., Brookings. Remote Sensing Inst.

REMOTE SENSING OF SOILS, LAND FORMS, AND LAND USE IN THE NORTHERN GREAT PLAINS IN PREPARATION FOR ERTS APPLICATIONS

C. J. Frazee, F. C. Westin, J. Gropper, and V. I. Myers Feb. 1972 28 p refs Original contains color illustrations
(Grant NGL-42-003-007)
(NASA-CR-125667; RSI-72-02) Avail: NTIS CSCL 08G

Research to determine the optimum time or season for obtaining imagery to identify and map soil limitations was conducted in the proposed Oahe irrigation project area in South Dakota. The optimum time for securing photographs or imagery is when the soil surface patterns are most apparent. For cultivated areas similar to the study area, May is the optimum time. The density slicing analysis of the May image provided additional and more accurate information than did the existing soil map. The soil boundaries were more accurately located. The use of a density analysis system for an operational soil survey has not been tested, but is obviously dependent upon securing excellent photographs for interpretation. The colors or densities of photographs will have to be corrected for sun angle effects, vignetting effects, and processing to have maximum effectiveness for mapping soil limitations. Rangeland sites were established in Bennett County, South Dakota to determine the usefulness of ERTS imagery. Imagery from these areas was interpreted for land use and drainage patterns. Author

N72-18346*# Geological Survey, Bismarck, N.Dak. Water Resources Div.

THERMAL STUDY OF THE MISSOURI RIVER IN NORTH DAKOTA USING INFRARED IMAGERY

Orlo A. Crosby 1971 51 p refs Sponsored by NASA Original contains color illustrations
(NASA-CR-125639) Avail: NTIS CSCL 08H

Studies of infrared imagery obtained from aircraft at 305- to 1,524-meter altitudes indicate the feasibility of monitoring thermal changes attributable to the operation of thermal electric plants and storage reservoirs, as well as natural phenomena such as tributary inflow and ground water seeps in large rivers. No identifiable sources of ground water inflow below the surface of the river could be found in the imagery. The thermal patterns from the generating plants and the major tributary inflow are readily apparent in imagery obtained from an altitude of 305 meters. Portions of the tape-recorded imagery were processed in a color-coded quantization to enhance the displays and to attach quantitative significance to the data. The study indicates a marked decrease in water temperature in the Missouri River prior to early fall and a moderate increase in temperature in late fall because of the Lake Sakakawea impoundment. Author

N72-18347# Lockheed Missiles and Space Co., Palo Alto, Calif.

SIMULTANEOUS MEASUREMENT OF IONOSPHERE PARAMETERS BY THE METHOD OF INCOHERENT RADIOWAVE SCATTERING AND BY ARTIFICIAL EARTH SATELLITE SIGNALS

G. K. Solodvnikov, G. N. Tkachev, V. M. Migunov, and V. M. Lazarenko [1971] 4 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 5, 1971 p 794-796
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The reduced phase difference between two coherent oscillations at 20 and 30 MHz were recorded during reception of signals from Intercosmos 2 and Cosmos 321 in February and March 1970. Measurements of the total number of electrons were compared, and electron profiles for altitudes up to 1000 km are given. It is concluded that both methods of determining the ionospheric electron density are approximately equivalent in accuracy. N.E.N.

N72-18348# Lockheed Missiles and Space Co., Palo Alto, Calif.

VARIATIONS IN N AND NO AT 100 - 250 km ALTITUDES

V. A. Krasnopolskii [1971] 8 p refs Transl. into ENGLISH from Geomagnetizm i Aeronomiya (Moscow), v. 11, no. 5, 1971 p 825-831
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Processes of N and NO formation, the altitude profile of these components in the ionosphere, and their variations were studied, based on data received by the Cosmos 224 satellite, as a function of solar activity. Diurnal variations were of particular interest. Formation and dissociation of N and NO, the connection between the rates of ion and N formation, NO concentration for photochemical equilibrium conditions, and the role of diffusion and mixing were considered. K.P.D.

N72-18349*# Toronto Univ. (Ontario). Dept. of Geography.

COHERENT OPTICAL DATA PROCESSING AND REMOTELY SENSED IMAGERY

E. Bruce MacDougall May 1969 66 p refs
(NASA Order R-09-020-024; Contract DI-14-08-0001-11259)
(NASA-CR-125640; USGAS-IR-NSA-145) Avail: NTIS CSCL 08G

It is shown that an automatic imaging system consisting of a combination of optical and digital computer elements is feasible and has considerable advantages over direct image scanning systems. With such a system, it is possible to process very large quantities of remotely sensed image spectra. Author

N72-18350*# California Univ., Los Angeles.

ANALYSIS OF URBAN RESIDENTIAL ENVIRONMENTS USING COLOR INFRARED AERIAL PHOTOGRAPHY: AN EXAMINATION OF SOCIOECONOMIC VARIABLES AND PHYSICAL CHARACTERISTICS OF SELECTED AREAS IN THE LOS ANGELES BASIN, WITH ADDENDUM: AN APPLICATION OF THE CONCEPTS OF THE LOS ANGELES RESIDENTIAL ENVIRONMENT STUDY TO THE ONTARIO-UPLAND REGION OF CALIFORNIA

Robert H. Mullens, Jr. and Leslie W. Senger (Calif. Univ., Los Angeles) May 1969 185 p refs Prepared by the Geol. Surv. in cooperation with Calif. Univ., Los Angeles. Dept. of Geography Original contains color illustrations rept. based on Robert H. Mullens, Jr. M.S. Thesis - Calif. Univ., Los Angeles
(NASA Order W-12570; Contract DI-14-08-0001-10674)
(NASA-CR-125642; USGS-IR-NASA-153) Avail: NTIS CSCL 08G

Aerial photographs taken with color infrared film were used to differentiate various types of residential areas in the Los Angeles basin, using characteristics of the physical environment which vary from one type of residential area to another. Residential areas of varying quality were classified based on these characteristics. Features of the physical environment, identifiable on CIR aerial photography were examined to determine which of these are the best indicators of quality of residential areas or social areas, as determined by the socioeconomic characteristics of the inhabitants of the selected areas. Association between several physical features and the socioeconomic variables was found to exist. Author

N72-18351*# Geological Survey, Washington, D.C.

GEOGRAPHIC APPLICATIONS PROGRAM: REPORTS COMPLETED AND IN PREPARATION

Robert H. Alexander, comp. Aug. 1969 16 p refs
(NASA Order W-12570)
(NASA-CR-125644; USGS-IR-NASA-154) Avail: NTIS CSCL 08F

The purpose of the present compilation is to bring together for ready reference a list of all reports, both completed and in preparation, resulting from NASA sponsorship of the geography program. Wherever possible, complete bibliographic citations are given. Since some of the 141 reports listed are not yet completed, citations can not all be in complete form. The reason for including incomplete citations is the sponsor's need for rather rapid feed-back of information so that it can have a bearing on on-going program planning. This should, therefore, be considered a working bibliography. Author

N72-18352*# Geological Survey, Flagstaff, Ariz.
GEOLOGIC EVALUATION OF REMOTE SENSING DATA, SITE 157, AWZA-BORREGO DESERT, CALIFORNIA
Edward W. Wolfe Mar. 1969 61 p refs
(NASA Order R-09-020-011)
(NASA-CR-125650; USGS-IR-NASA-144) Avail: NTIS CSCL 08G

Remote sensing data were obtained at site 157 in May 1968 under mission 73 of the NASA aircraft program. The site is located in an area of high temperatures and extreme aridity immediately west of the Imperial Valley, Southern California. Site 157 is partially surrounded by pre-Cenozoic crystalline rocks exposed in the Fish Creek, Vallecito, and Tierra Blanca Mountains. The study area itself is underlain by more than 20,000 feet of sedimentary strata of late Cenozoic age. Author

N72-18353*# Geological Survey, Washington, D.C.
AERIAL INFRARED RECONNAISSANCE OF THE STEAMBOAT SPRINGS AREA NEVADA
R. M. Moxham and Gordon W. Greene Dec. 1968 40 p refs
(NASA Order T-65754-G)
(NASA-CR-125651; USGS-IR-NASA-141) Avail: NTIS CSCL 08G

The aerial IR technique quickly and efficiently delineates high temperatures associated with the first order phenomena of convective heat transfer in major geothermal systems. A reconnaissance geophysical exploration for such geothermal systems in the Steamboat Springs area Nevada, is reported. The infrared (IR) radiance of the terrain is mapped and a preliminary assessment of its relation to the thermal activity is made. Author

N72-18354*# Georgia Univ., Athens.
VEGETATION CHANGES CAUSED BY FIRE IN THE FLORIDA FLATWOODS AS OBSERVED BY REMOTE SENSING
W. T. Mealor, Jr. and Merle C. Prunty, Jr. Jun. 1969 15 p refs Original contains color illustrations
(NASA Order R-09-020-024; Contract DI-14-08-0001-11251)
(NASA-CR-125649; USGS-IR-NASA-148) Avail: NTIS CSCL 02F

The nature of the flatwoods and the role that ground fires have played in maintaining them are discussed. Emphasis is placed on the areal and temporal extent of burns as recorded uniformly by remote sensors. Thermal infrared, color infrared, and Ektachrome imagery were obtained from sensors flown by a NASA aircraft at 15,000 feet over a test site in Osceola County, Florida, in March 1968. The overall pattern of burning can be sequenced and mapped uniformly from the imagery. By comparing the various imagery, areal and temporal extent of burned areas can be determined. It was concluded that remote sensed imagery provides more accurate and areally comprehensive media for assessing the impact of ground fires on the landscape of the flatwoods region than are available from any other data source. Author

N72-18355*# Geological Survey, Menlo Park, Calif.
GEOLOGIC UTILITY OF SMALL-SCALE AIRPHOTOS
Malcolm M. Clark 1969 73 p refs
(NASA Order T-80485)
(NASA-CR-125656; USGS-IR-NASA-161) Avail: NTIS CSCL 08G

The geologic value of small scale airphotos is emphasized by describing the application of high altitude oblique and 1:120,000 to 1:145,000 scale vertical airphotos to several geologic problems in California. These examples show that small-scale airphotos can be of use to geologists in the following ways: (1) high altitude, high oblique airphotos show vast areas in one view; and (2) vertical airphotos offer the most efficient method of discovering the major topographic features and structural and lithologic characteristics of terrain. Author

N72-18356*# Geological Survey, Denver, Colo.
GENERALIZED GEOLOGIC EVALUATION OF SIDE LOOKING RADAR IMAGERY OF THE TETON RANGE AND JACKSON HOLE, NORTHWESTERN WYOMING
J. D. Love Feb. 1970 25 p refs
(NASA Order R-09-020-011)
(NASA-CR-125646; USGS-IR-NASA-168) Avail: NTIS CSCL 08G

A generalized geologic evaluation of lines, localities, and features of various types that are visible on a series of radar image strips covering the Teton Range and Jackson Hole in northwestern Wyoming, is given. No attempt was made to collate a complete geologic map with the radar image at each locality. Formation names, problems of geologic interpretation, and details of stratigraphy and structure that are not directly pertinent to a study of the imagery are omitted, but reference is made to publications that contain this type of supplementary information. Author

N72-18357*# Oregon State Univ., Corvallis.
THE EMPLOYMENT OF WEATHER SATELLITE IMAGERY IN AN EFFORT TO IDENTIFY AND LOCATE THE FOREST-TUNDRA ECOTONE IN CANADA
Susan A. Aldrich, Frank T. Aldrich, and Robert D. Rudd Nov. 1969 45 p refs
(NASA Order W-12589; Contract Di-160-75-01-32-10)
(NASA-CR-125647; USGS-IR-NASA-169) Avail: NTIS CSCL 08G

Weather satellite imagery provides the only routinely available orbital imagery depicting the high latitudes. Although resolution is low on this imagery, it is believed that a major natural feature, notably linear in expression, should be mappable on it. The transition zone from forest to tundra, the ecotone, is such a feature. Locational correlation is herein established between a linear signature on the imagery and several ground truth positions of the ecotone in Canada. Author

N72-18358*# Raytheon Co., Lexington, Mass.
GEOGRAPHIC ANALYSIS OF MULTIPLE SENSOR DATA FROM THE NASA/USGS EARTH RESOURCES PROGRAM
Richard F. Pascucci, Gary W. North, Rose Anne Albrizio, and Barry D. Shelkin May 1969 198 p Original contains color illustrations
(NASA Order W-12589)
(NASA-CR-125638; USGS-IR-NASA-156) Avail: NTIS CSCL 08G

Qualitative and quantitative analyses were made of multi-sensor data acquired during aircraft missions. While the principal analysis effort was concentrated on imagery taken over test sites in Southern California, data were also studied from records acquired on missions over test sites at Phoenix, Chicago, Asheville, and New Orleans. The objectives of the analyses were: (1) to determine the capabilities of ten remote sensors in identifying the elements of information necessary in conducting geographic investigations in land use analysis, urban problems, surface energy budget, and soil moisture; (2) to determine the feasibility of using these sensors for these purposes at orbital altitudes; and (3) to collate and analyze ground and air data previously collected and assemble it in a format useful in the accomplishment of cost effectiveness studies. Author

N72-18359*# Northrop Services, Inc., Huntsville, Ala.
AURORAL OVAL KINEMATICS PROGRAM
R. H. Comfort Jan. 1972 109 p refs

(Contract NAS8-21810)
(NASA-CR-61373; TR-241-1028) Avail: NTIS CSCL 03B

A computer program which determines the geographic location of the auroral oval for given universal time and level of geomagnetic activity was developed for use on the IBM 7094 computer. The program provides both printed output of geographic coordinates of auroral oval boundaries and polar plots of the auroral oval. In addition, there is available a time-integration option which indicates how long a given location is under the auroral oval during a specified period. A description is given of the program and its use. Author

N72-18360# National Environmental Satellite Center, Washington, D.C.

LIMITS ON THE ACCURACY OF INFRARED RADIATION MEASUREMENTS OF SEA-SURFACE TEMPERATURE FROM A SATELLITE

Charles Braun Dec. 1971 31 p refs
(NOAA-TM-NESS-30) Avail: NTIS

The accuracy with which measurements of sea surface temperature can be made through a cloud-free atmosphere with either a single- or two-channel radiometer is discussed. The single-channel radiometer is assumed to operate in one of three infrared spectral regions. The overall accuracy of radiometric temperature measurements made with this instrument when viewing at normal incidence is estimated to be 2 C to 3 C for intervals (I) and (II) and 1 C to 1.5 C for interval (III), provided that independent measurements are made of the atmospheric temperature and water vapor profiles, with a separate instrument. The two-channel radiometer is assumed to operate in two infrared spectral regions to eliminate the effects of atmospheric water vapor absorption. Author

N72-18361# Joint Publications Research Service, Arlington, Va.

INVESTIGATION OF THE MOISTURE CONTENT IN THE STRATOSPHERE

B. I. Ogorodnikov, V. I. Kozhevin, and I. V. Petryanov 28 Feb. 1972 5 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 200, no. 6, 1971 p 1333-1335
(JPRS-55285) Avail: NTIS

Aerostat measured stratospheric moisture distribution over the central part of the U.S.S.R. European territory establishes the lowest values at 12 and 20 km heights. Above this level moisture content increases and exceeds at 31 to 32 km the 12 km level by approximately 5 to 10 times. It is concluded that the stratosphere has a specific moisture content of around 0.05 g of water per kg of air at the maximal investigated height of 32 km. G.G.

N72-18362*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE LIGHT ION TROUGH

Harry A. Taylor, Jr. Feb. 1972 35 p refs Submitted for publication
(NASA-TM-X-65832; X-621-72-44) Avail: NTIS CSCL 03B

Several fundamental characteristics of LIT (light ion trough), including evidence of diurnal variation as well as response to magnetic disturbances, are identified. These identifications were made using the Bennett radio frequency ion mass spectrometer onboard the OGO-6 from 1969 to 1970. It was shown that the LIT, rather than the total ionization trough, appears as a more meaningful indicator of the plasmapause. This makes the LIT a fundamental parameter for studies of the formation and maintenance of the plasmasphere. E.H.W.

N72-18363*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

EVIDENCE FOR THE EXISTENCE OF NEGATIVE IONS IN THE D AND LOWER E REGIONS AT TWILIGHT

J. A. Kane Feb. 1972 46 p refs
(NASA-TM-X-65829; X-625-72-18) Avail: NTIS CSCL 04A

Evidence for negative ions in the lower ionosphere is based on the difference between simultaneously measured profiles of electron and positive ion density. The electron density profiles reported were obtained from ground-to-rocket radio wave absorption measurements while Gerdien ion traps were used to measure the positive ion profiles. Results from a series of three rockets launched from Thumba, India near sunset on 27 March, 1970 indicate that a significant number of negative ions are formed at altitudes as high as 95 km at twilight. Author

N72-18364*# Techtran Corp., Glen Burnie, Md.

THE QUESTION OF PHASE DELAY IN OBSERVATIONS OF GROUND TIDES

B. P. Pertsev Washington NASA Mar. 1972 6 p refs Transl. into ENGLISH of French article "Sur la Question du Retard de Phases dans les Observations des Marees Terrestres" from Marees Terrestres, Bull. d'Inform., 1 Sep. 1971 p 3108-3111 appearing in "Metodika Izmereniya Zemnykh i Medelennykh Deformatsiy Zemnoy Poverkhnosti" Moscow, Inst. of Phys. of the Earth, 1970 p 110-112
(Contract NASw-2037)
(NASA-TT-F-14170) Avail: NTIS CSCL 08K

The contribution of ground tides to the secular slackening of the rotation of the Earth is evaluated by elimination of all systematic, instrumental, oceanic and meteorological influences on observations of ground tides. Author

N72-18365*# Techtran Corp., Glen Burnie, Md.

INDIRECT EFFECTS OF MARINE TIDES ON M2 WAVE FREQUENCY

B. P. Pertsev Washington NASA Mar. 1972 11 p refs Transl. into ENGLISH of French article "Effect Indirect des Marees Oceaniques dans la Frequence de l'Onde M2" from Marees Terrestres, Bull. d'Inform. 1 Sep. 1971 p 3100-3107 appearing in the book "Vrashcheniye i Prilivnyye Deformatsii Zemli" Kiev, 1970 p 156-165
(Contract NASw-2037)
(NASA-TT-F-14173) Avail: NTIS CSCL 08C

Cotidal maps of the semi-diurnal waves of the world ocean are used to calculate the effect of marine tides on M2 wave frequency. Author

N72-18366*# Techtran Corp., Glen Burnie, Md.

ESTIMATION OF THE EFFECTS OF MARINE TIDES ON GROUND TIDES AT POINTS REMOTE FROM THE OCEANS

B. P. Pertsev Washington NASA Mar. 1972 21 p refs Transl. into ENGLISH from the book "Zemnyye Prilivy i Vnutr. Stroyeniye Zemli" Moscow, Inst. of Phys. of the Earth, 1967 p 10-22
(Contract NASw-2037)
(NASA-TT-F-14174) Avail: NTIS CSCL 08C

The indirect effect of marine tides on earth tides is studied using a representation of the former as a series of spherical functions, with the deformation of the earth as a supplementary periodic pressure exerted by the masses of water. Author

N72-18367# Weapons Research Establishment, Salisbury (Australia).

IONOSPHERIC DATA FOR OCTOBER 1970 FROM SALISBURY, SOUTH AUSTRALIA

Aug. 1971 28 p refs
(SAD-1970/10(S)) Avail: NTIS

Tables of recorded hourly values of foF2, M3000F2, and f-min data are presented for Salisbury, South Australia. Author

N72-18368# Weapons Research Establishment, Salisbury (Australia).

IONOSPHERIC DATA FOR DECEMBER 1970 FROM SALISBURY, SOUTH AUSTRALIA

Sep. 1971 28 p refs
(SAD-1970/12(S)) Avail: NTIS

Tables of recorded hourly values of foF2, M3000F2, and f-min data are presented for Salisbury, South Australia. Author

N72-18369# Weapons Research Establishment, Salisbury (Australia).

IONOSPHERIC DATA FOR NOVEMBER 1970 FROM SALISBURY, SOUTH AUSTRALIA

Sep. 1971 28 p refs
(SAD-1970/11(S)) Avail: NTIS

Tables of recorded hourly values of foF2, M3000F2, and f-min data are presented for Salisbury, South Australia. Author

N72-18370# Japan Meteorological Agency, Tokyo.

AEROLOGICAL DATA OF JAPAN, MARCH 1971

Mar. 1971 296 p refs
Avail: NTIS

Monthly upper atmosphere data are presented for Japan and its vicinity. The data are corrected for temperature error due to solar radiation and the effect of low temperature on the vacuum cell. The curvature of the earth is taken into account in the computation of winds aloft. Standard pressure levels, temperature and humidity levels of significance, wind significant levels, pilot-balloon data, transmitter specifications, ground equipment, and the location of meteorological stations are included. K.P.D.

N72-18371# Japan Meteorological Agency, Tokyo.

AEROLOGICAL DATA OF JAPAN, ATMOSPHERIC OZONE, ATMOSPHERIC ELECTRICITY, LONG WAVE RADIATION, 1968

1971 85 p refs
Avail: NTIS

Upper air data are reported for three kinds of meteorological elements, i.e., ozone, atmospheric electricity and long wave radiation fluxes, which were observed by specially designed radiosondes. The ozone observation was commenced in March, 1968. The atmospheric electricity has been observed since IGY, and the radiation since January 1965. Stations where these observations were carried out are listed together with their latitudes, longitudes, and elevations. All the evaluated results of successful observations, are listed: 32 ozone, 93 atmospheric electricity, and 65 radiation data. Author

N72-18372# Japan Meteorological Agency, Tokyo.

AEROLOGICAL DATA OF JAPAN, FEBRUARY 1971

Feb. 1971 288 p refs
Avail: NTIS

Monthly upper air data observed in Japan and its vicinity during February 1971 are presented. Data are corrected for temperature error due to solar radiation and the effects of low temperature on the vacuum cell; the curvature of the earth is taken into account in the computation of upper winds. Author

N72-18373*# Geological Survey, Washington, D.C.

MAPPING MONTANE VEGETATION IN SOUTHERN CALIFORNIA FROM COLOR INFRARED IMAGERY

Richard A. Minnich (Calif. Univ., Riverside), Leonard W. Bowden (Calif. Univ., Riverside), and Robert W. Pease (Calif. Univ., Riverside) Apr. 1969 73 p refs Prepared by the Geol. Surv. in cooperation with Calif. Univ., Riverside. Dept. of Geography Original contains color illustrations
(NASA Order R-09-020-024; NASA Order W-12570; Contract DI-14-08-0001-10674; 160-75-01-32-10)
(NASA-CR-125645; USGS-IR-NASA-152) Avail: NTIS CSCL 08B

Mapping a large area in California like the San Bernardino Mountains, demonstrated that color infrared photography is suitable for detailed mapping and offers potential for quantitative mapping. The level of information presented is comparable or superior to the most detailed mapping by ground survey. Author

N72-18374# Oak Ridge National Lab., Tenn. Ecological Sciences Div.

ERROR ANALYSIS OF ECOLOGICAL MODELS

R. V. ONeill 1971 32 p refs Presented at 3d Natl. Symp. on Radioecology, Oak Ridge, Tenn., 10 May 1971 Sponsored by AEC
(CONF-710501-35) Avail: NTIS

Untested hypotheses are sometimes involved in model development. For example, it may be difficult to predetermine optimal model complexity, i.e., the number of state variables or compartments to be included in a model for acceptable accuracy. The hypothesis that greater complexity leads to greater accuracy was tested by analyzing the total uncertainty accompanying a model prediction. In general, systematic bias, resulting from abstracting the system into a few variables, is inversely related to complexity. As more parameters are added to the model, they must be quantified in field and laboratory experiments which are never error-free. If these measurement errors are promulgated through a simulation, they contribute to uncertainty in model predictions. By applying Monte Carlo simulation techniques, it was possible to account explicitly for each component of the total uncertainty. Author (NSA)

N72-18375# Army Engineer Nuclear Cratering Group, Livermore, Calif.

CRATER STABILITY UNDER THE INFLUENCE OF LARGE SEISMIC MOTIONS

T. J. Shackelford Sep. 1971 39 p refs
(AD-730762; PNE-5013) Avail: NTIS CSCL 13/2

The ORT is an empirical study of the effects of large seismic motions on crater slopes. Data were obtained from measurements of the effects of the seismic motions generated by the Handley Event on the Cabriolet and Schooner craters. Accelerometers recorded the ground motions; aerial photographs and ground surveys documented the permanent ground displacements. The Handley Event was detonated on Pahute Mesa at the Nevada Test Site approximately 10,000 ft from the Cabriolet crater and 18,000 ft from the Schooner crater. The slopes at Cabriolet were subjected to the estimated peak radial (horizontal) acceleration of 0.74 G; the slopes at Schooner, to 0.36 G. Material displacements at Cabriolet and Schooner craters were confined to the loose surface material and individual boulders. Author (GRA)

N72-18376# Naval Research Lab., Washington, D.C.

NUMERICAL CALULATION OF DISPERSION RELATIONS FOR INTERNAL GRAVITY WAVES Interim Report

Thomas H. Bell, Jr. 7 Sep. 1971 46 p refs
(Proj. A37-370/F08-125-703)
(AD-732379; NRL-7294) Avail: NTIS CSCL 08/3

Numerical procedures have been developed to calculate the frequency/wave number dispersion relations for internal gravity waves in arbitrary density gradients. The basic properties of the differential equation governing these waves have been considered in developing these procedures. These procedures have been used to develop a set of Fortran subroutines capable of computing, printing in tabular form, and producing line printer plots of the dispersion relations. Source listings of these subroutines and full descriptions of their use are given. To illustrate the accuracy of the system and to display the results of violating certain restrictions involved in the numerical procedure, an extensive comparison is made between numerical results and an analytic solution for the dispersion relations. The analytical model corresponds to a hypothetical fluid system which closely approximates the average water properties measured during field tests in Bute Inlet, British Columbia, a fjord-type estuary with a density structure characterized by a strong gradient between two nearly homogeneous layers. Author (GRA)

N72-18377# Army Foreign Science and Technology Center, Charlottesville, Va.

INVESTIGATION OF THE OROGRAPH SYSTEM IN THE STEREOTRIGOMAT

V. A. Myshlyaev 22 Sep. 1971 12 p refs Transl. into ENGLISH from Geod. Kartografiya (USSR), no. 3, 1970 p 48-53

(AD-732479; FSTC-HT-23-335-71; ACSI-J-9722) Avail: NTIS CSCL 08/2

Various techniques are given for determining the accuracy of universal stereophotogrammetric instruments. Author (GRA)

N72-18378# Raven Industries, Inc., Sioux Falls, S. Dak.
SKYHOOK CHURCHILL 1971 Interim Report for 1971 •
Thomas Pappas and Paul S. White 15 Oct. 1971 122 p
(Contract N00014-71-C-0295)
(AD-732483; R-1071006) Avail: NTIS CSCL 04/1

The program was funded to conduct balloon field operations from Fort Churchill, Manitoba and at other sites as designated. A field crew, suspension and rigging hardware, aircraft and helicopter tracking, parachutes, balloon telemetry and control instrumentation, electronic tracking, and reports and documentation were provided as necessary. Thirteen launches were performed at Fort Churchill, one at Dauphin, Manitoba, and one at Sioux Falls, South Dakota. Of these fifteen flights, two were aborted on the ground and one failed during ascent. This report describes individual flights, equipment used, flight data, and various program information. Author (GRA)

N72-18379# Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
THE CHESAPEAKE BAY INSTITUTE WAVE FOLLOWER, PART 2
Mart Peep and Ronald J. Flower Sep. 1971 63 p refs
(Contract N00014-67-A-0163-0006; NR Proj. 083-016)
(AD-732472; REF-71-8-Pt-2; TR-73) Avail: NTIS CSCL 08/10

An electrohydraulic wave follower has been designed and laboratory tested. The instrument holds a hot-film or hot-wire anemometer probe at various distances (fixed or variable) above and close to the moving sea surface. The report summarizes two field trips made in 1969 to check its mechanical and electrical performance and to obtain wind and wave records. Author (GRA)

N72-18380# Aerospace Corp., El Segundo, Calif. Lab. Operations.
REMOTE SENSING OF ATMOSPHERIC DENSITY BELOW 250 km. VOLUME 1: SYSTEM CONCEPT
Arthur B. Prag 15 Aug. 1971 77 p refs
(Contract F04701-71-C-0172)
(AD-732858; TR-0172(2260-10)-1-Vol-1; SAMSO-TR-71-261-Vol-1) Avail: NTIS CSCL 04/1

A novel method is presented for the determination of the altitude profile of molecular nitrogen between approximately 120 and 250 km. The profile is remotely measured by a satellite-borne ultraviolet spectrometer. The design concept also includes the remote determination of the fast photoelectron flux and the molecular oxygen and the sodium D-line emission profiles, all with a vertical resolution of about 5 km and a horizontal resolution of about 400 km. Approximately 50 profiles per orbit are measured. Author (GRA)

N72-18381# Aerospace Corp., El Segundo, Calif. Lab. Operations.
REMOTE SENSING OF ATMOSPHERIC DENSITY BELOW 250 km. VOLUME 2: QUICK-LOOK DATA ANALYSIS AND SYSTEM ERROR ANALYSIS
Arthur B. Prag 1 Nov. 1971 43 p refs
(Contract F04701-71-C-0172)
(AD-732859; TR-0172(2260-10)-1-Vol-2; SAMSO-TR-71-260-Vol-2) Avail: NTIS CSCL 04/1

A method for quick-look data analysis and a complete error analysis is presented for the previously described remote sensing system for determination of atmospheric density below 250 km. The quick-look analysis is suitable for on-board implementation, and is expected to produce an overall error of less than 1 percent in the relative N2 profile. The absolute errors are expected to be as high as 28 percent, mostly because of the difficulty in absolutely calibrating the spectrometer. This error can be significantly reduced, and the entire system calibrated, by a comparison of the deduced N2 densities with the results from a single rocket-borne mass spectrometer flight. Author (GRA)

N72-18382# Naval Postgraduate School, Monterey, Calif.
THE SOUND PROPAGATION CONDITIONS IN THE BLACK SEA M.S. Thesis
Yavuz Ergengil Sep. 1971 120 p refs
(AD-733196) Avail: NTIS CSCL 20/1

The sound propagation conditions in the central part of the Black Sea were investigated. Profiles of temperature and salinity were generated by averaging data from the U.S. National Oceanographic Data Center over monthly periods. Wilson's equation was used to compute sound velocities and a digital computer program provided plots of sound velocity versus depth and selected ray trace diagrams. Seasonal temperature, salinity and sound velocity variations are found only in the upper layer of the Black Sea. Below 125 m, seasonal variations are insignificant. A well defined sound channel exists in the Black Sea that is caused by a cold intermediate layer. Therefore, a seasonal convergence zone is observed during the months of May, November and December. Finally, bottom reflectivity was calculated by Rayleigh's formula and surface backscattering strength was calculated according to Schulkin and Shaffer. Author (GRA)

N72-18383# Naval Postgraduate School, Monterey, Calif.
COLLECTION AND PRELIMINARY ANALYSIS OF UNDER-ICE AMBIENT NOISE DATA, CAPE NORTH, JANUARY - APRIL 1971 M.S. Thesis
Austen Martin Oake Sep. 1971 106 p refs
(AD-733177) Avail: NTIS CSCL 20/1

Ambient noise data was collected from bottom-mounted hydrophones in 65 fms of water near Cape North, Nova Scotia, from January to April 1971. Preliminary analyses indicate that generalizations made from data collected at other sites can be used in only the broadest sense to predict noise levels at Cape North. The open water spectral shapes resemble deep water spectral shapes proposed by Wenz (1962) rather than shallow water spectra found by Piggott (1964) at another location on the Scotian Shelf. Under-ice noise levels are below open water levels in the frequency range 40 Hz to 2 kHz, but above this frequency, mechanical noise sources within the ice pack elevate levels above those found under open water conditions. GRA

N72-18384# California Univ., Los Angeles. Plasma Physics Group.
CHANGES IN MAGNETOSPHERIC CONFIGURATION DURING SUBSTORM GROWTH PHASE
Ferdinand V. Coroniti and Charles F. Kennel Nov. 1971 37 p refs
(Contract N00014-69-A-0200-4023)
(AD-733474; PPG-102) Avail: NTIS CSCL 04/1

Four simple calculations suggest that the magnetosphere changes its configuration during substorm growth phase. A flaring tail model indicates that the observed increases in geomagnetic tail field can only be explained if the dayside magnetopause shrinks by 1-2 RE. The same assumption is needed to explain large magentic decreases observed at geostationary orbit. A plasma sheet model, consistent with a flaring tail, indicates that increased tail flaring leads to plasma sheet thinning, and a decrease in northward magentic field, during substorm growth phase. The motion of the inner edge of the plasma sheet, and consequently an equatorward shift of the nightside auroral oval, is consistent with the above structural modifications. Author (GRA)

N72-18385# Teledyne Geotechnical, Alexandria, Va.
SAAC EVALUATION OF THE SAAC/LASA SYSTEM
William C. Dean, R. O. Ahner, and E. F. Chiburis Aug. 1971 120 p refs
(Contract F33657-71-C-0510; ARPA Order 1620; VELA Proj.

T/1709)
(AD-733195) Avail: NTIS CSCL 17/10

The report is an evaluation of the SAAC/LASA system known as the integrated Seismic Research Signal Processing System which was programmed by IBM. The system operates in two parts. The Detection Processor performs data acquisition and signal detection. The Event Processor is designed to recognize true signals and false alarms and to extract event parameters, refine locations, and publish an earthquake bulletin. The Event Processor is programmed to work either in an automated mode in which the computer analyzes events and publishes the bulletin without help from a seismic analyst, or to act as an aide to the analyst who can edit the event processing on a display console. The Detection Processor works well as a data acquisition, recording, and signal detection system. The Event Processor with analyst editing is able to handle the data output from LASA and produce an acceptable seismic bulletin within 24 hours. Author (GRA)

N72-18386# Naval Oceanographic Office, Washington, D.C.
BIRDS EYE 4-70, 22 SEPTEMBER - 7 OCTOBER 1970
R. F. Freeman and R. D. Rankin Oct. 1971 137 p
(AD-733062; NOO-IR-71-5) Avail: NTIS CSCL 08/12

BIRDS EYE 4-70 was a regularly scheduled Arctic Ocean ice reconnaissance mission covering the North American sector of the Arctic Ocean including Baffin Bay and Davis Strait between 22 September and 7 October 1970. Ice was observed under daylight or twilight conditions. Weather conditions were generally good, except north of Greenland and west of Prince Patrick and Banks Islands. Remnant ice with noted refreezing was observed in Baffin Bay. An extensive area of new ridges existed northwest of Ellesmere Island. Severe ice conditions existed in the Alaskan area. The ice was photographically mapped at several locations. Author (GRA)

N72-18387# Applied Theory, Inc., Los Angeles, Calif.
LOFTING OF PARTICULATES BY A HIGH SPEED WIND Final Report
Bruce Hartenbaum Sep. 1971 68 p refs
(Contract DASA01-70-C-0041; DNA Proj. NWER-XAXS)
(AD-733061; ATR-71-25; DNA-2737) Avail: NTIS CSCL 18/3

Wind tunnel studies of particulate lofting were conducted at free stream speeds of between 112 and 376 fps. Measurements were made of the rate at which particulates were lofted, of the wind velocity profile and of the number density of airborne particulates. The measurement bearing the most practical significance was that of the lofting rate; the measured lofting rate was only 1/10 that of the maximum rate predicted by current theory, although the lofting rate was found to be directly proportional to the shear stress velocity in accord with the theory. The velocity profile within the boundary layer but at heights greater than the effective roughness created by the particulate flow is of the form given by Prandtl's law for flow past a wall. Boundary layer calculations in conjunction with the measurements show that Owen's form for the flow law cannot hold near the head of the boundary layer. Author (GRA)

N72-18388# Stanford Research Inst., Menlo Park, Calif.
EXCITATION AND DEEXCITATION OF VIBRATION N2 BY OXYGEN ATOMS Final Report
Graham Black and Donald J. Eckstrom Oct. 1971 71 p refs
(Contract DAHC04-70-C-0036; ARPA Order 1482; SRI Proj. PYU-8626)
(AD-733055) Avail: NTIS CSCL 04/1

The earth's upper atmosphere continuously emits infrared radiation. Some of this radiation is powered by the energy stored in vibrationally excited nitrogen, and it has been suggested that this is produced when nitrogen quenches O(singlet D). In this reaction the 1.96 eV electronic excitation of O(singlet D) is transferred to vibrational and rotational energy of the nitrogen and kinetic energy. Because no measurements of the fraction that appears as vibrational energy were available, the first task of the authors' research program was to measure this fraction, using Raman spectroscopy to determine the population of N2(v-1) that is produced. The experimental findings support the theoretical estimate of the O(singlet D) vibrational energy. The authors obtain an efficiency of 8.3 plus or minus 6.5% for the conversion of O(singlet D) electronic energy to N2 vibrations. Once produced, the vibrationally excited nitrogen is deexcited only by collisions. Above 125 km, the vibrationally excited nitrogen is removed by diffusion, by electron quenching, and by vibrational-translational energy exchange with O(triplet P). The reaction rate for the process was found. Results are reported for N2-1% CO, N2-5% CO, and N2-5% O2-1% CO mixtures. An infrared-tracer technique was used. GRA

N72-18389# Princeton Univ., N.J.
NONADIABTIC BEHAVIOR OF RADIATION BELT PARTICLES
Harold E. Taylor and R. J. Hastie (United Kingdom Atomic Energy Authority, Abingdon) 26 Apr. 1971 14 p refs
(Contract F44620-70-C-0033; AF Proj. 9767)
(AD-733256; AFOSR-71-2984TR) Avail: NTIS CSCL 04/1

The boundary of the trapping region is observed to be at lower latitudes for higher-rigidity particles, a type of inverse Stormer effect. This effect is studied for particles having large mirror ratios by numerically tracing particle orbits and investigating nonadiabatic jumps in the first invariant. Analytical expression for these jumps are obtained for a dipole field, and a useful condition necessary for adiabaticity is obtained and applied to a more realistic model of the geomagnetic field. The numerical techniques applied to this realistic model predict the spatial profile and rigidity dependence of the boundary of the trapping region in the midnight meridian. The predicted boundary falls midway between the observed low-latitude cutoff of cosmic rays and the observed high-latitude boundary of the trapping region. Author (GRA)

N72-18390# Aerospace Corp., El Segundo, Calif. Satellite Systems Div.
APPLICATION OF A LIMIT ON STABLY TRAPPED ELECTRON FLUX, MARCH - MAY 1971
Michael Schulz 15 Sep. 1971 24 p refs
(Contract F04701-71-C-0172)
(AD-733334; TR-0172(2158)-1; SAMSO-TR-71-265) Avail: NTIS CSCL 04/1

From the viewpoint of satellite survivability, self-generated whistler-mode noise significantly limits the flux of relativistic electrons that can be injected into stable radiation belts by nuclear detonations. Author (GRA)

N72-18391# Naval Postgraduate School, Monterey, Calif.
REGRESSION TECHNIQUES FOR THE CALCULATION OF BALLISTIC WINDS UTILIZING SATELLITE INFRARED SPECTROPHOTOMETER DATA M.S. Thesis
John Richard Wright Sep. 1971 43 p refs
(AD-733231) Avail: NTIS CSCL 04/1

Three regression techniques for the calculation of ballistic winds using satellite infrared spectrophotometer (SIRS) data are evaluated. Experiments testing the derived methods are carried out using two SIRS-A data sets and one SIRS-B data set. In all three cases, the data sets are divided into a large dependent sample used to derive the regression equations and smaller independent sample for testing the equations' validity. One method, that of geostrophic calculations using regression derived D values of ballistic geopotential height is found to be superior to the other methods. Author (GRA)

N72-18392# Naval Postgraduate School, Monterey, Calif.
AN EXAMINATION OF MICROTHERMAL STRUCTURE STATISTICS AS CALCULATED FROM EXPENDABLE BATHYTHERMOGRAPH RECORDS M.S. Thesis
Frank Martin Hunt, Jr. Sep. 1971 82 p refs
(AD-733234) Avail: NTIS CSCL 08/10

Expendable Bathythermograph (XBT) temperature depth profile data from 17 locations in the north Pacific Ocean has been analyzed to extract information concerning the thermal microstructure. The microstructure information is then examined to determine if the distribution can be associated with the climatic regions of the north Pacific Ocean proposed by Tully. A modified binomial filter used by Roden to analyze STD data was applied to find a mean temperature series. A temperature perturbation series results when the mean is subtracted from the original XBT series. Two resulting parameters, average mean temperature perturbation vertical thickness scale and average maximum amplitude of the temperature perturbations, can be associated with the microstructure. The average mean temperature perturbation vertical thickness scale was found to increase with latitude from 20 degrees N to 55 degrees N, and as the thickness scale increased, the maximum amplitude of the perturbations was found to decrease. Author (GRA)

N72-18393# Aerospace Corp., El Segundo, Calif. Lab. Operations.

THE PATTERNS AND SOURCES OF HIGH-LATITUDE PARTICLE PRECIPITATION, JUNE 1970 - JANUARY 1971

George A. Paulikas 1 Nov. 1971 121 p refs
(Contract F04701-71-C-0172)
(AD-733336; TR-0172(2260-20)-7; SAMSO-TR-71-269) Avail: NTIS CSCL 04/1

The paper surveys the properties of the zones of particle precipitation at high latitudes and considers the average properties of particle influx from the outer magnetosphere as determined by satellite and rocket observations as well as ground-based techniques. The paper tries to associate source regions, and, if possible, precipitation mechanisms with each of the families of precipitating particles which collectively form the auroral zone. The precipitation patterns for both electrons and protons exhibit a diurnal variation. The several zones of particle precipitation can be placed in relationship to each other. The zone of electron precipitation is best described as consisting of a region at low latitudes where electrons with characteristic energies of tens of keV precipitate; this region merges and overlaps at the higher latitudes with another region characterized by precipitating electrons of about 0.5 keV. The limited data available indicate that the zone of proton precipitation spatially overlaps the zone of electron precipitation. The plasma sheet, the extraterrestrial ring current, the polar cusp, and the outer radiation belt are considered as source regions of precipitating particles. Brief surveys of the precipitation of helium ions and of possible means of artificially inducing particle precipitation are also included. Author (GRA)

N72-18394# Naval Postgraduate School, Monterey, Calif.

THE CHARACTERIZATION OF VARIABILITY IN TRANSMISSION LOSS IN THE OCEAN

Thomas D. Burnett Aug. 1971 46 p refs
(AD-733435; NPS-55ZA71081A) Avail: NTIS CSCL 20/1

The temporal and spacial variation in one-way transmission loss as experienced in the ocean due to short term temporal and small scale spacial variation in the acoustic environment is examined. This variation is characterized as a function of the transmission frequency, transmission range, source and receiver depths, predominant thermal structure and geographical locality. The results obtained clearly indicate that variability in transmission loss is indeed dependent upon system as well as environmental factors and suggestions are made as to the nature of the influences which control this variation. Author (GRA)

N72-18395# Pittsburgh Univ., Pa. Atmospheric Sciences Inst.

ATOMIC AND MOLECULAR PROCESSES IN ATMOSPHERIC ENVIRONMENTS

M. A. Biondi 28 Oct. 1971 34 p refs
(Contract DA-31-124-ARO(D)-440; ARPA Order 826)
(AD-733432; AROD-6563-36-P; PR-11) Avail: NTIS CSCL 04/1

The report summarizes research performed at the Pittsburgh Atmospheric Sciences Institute on atomic and molecular physics related to atmospheric sciences. It covers research from May thru October 1971. GRA

N72-18396# Naval Civil Engineering Lab., Port Hueneme, Calif.

SEAFLOOR PENETRATION TESTS: PRESENTATION AND ANALYSIS OF RESULTS Technical Note, Dec. 1969 - Jul. 1970

H. J. Migliore and H. J. Lee Aug. 1971 64 p refs
(YF Proj. 38-535-002-01-009)
(AD-732367; NCEL-TN-1178) Avail: NTIS CSCL 08/10

A series of eleven in situ penetration tests was conducted by the Naval Civil Engineering Laboratory MEL at two seafloor sites. The objectives of these tests were to illustrate the capabilities of existing penetration evaluation equipment and to acquire data for use in evaluating a series of proposed penetration prediction techniques. The tests consisted of allowing two types of objects to free-fall into the seafloor with the accelerations experienced by the objects during penetration being recorded mechanically. The resulting data were subjected to a regression analysis which yielded information about the penetration mechanism but no practical results. This was followed by a physical analysis based on static soil mechanics relations. The latter analysis was shown to yield predictions of penetration depth which were within 50 percent of the measured values. A suggested prediction technique based on this analysis is presented. Author (GRA)

N72-18397# Army Foreign Science and Technology Center, Charlottesville, Va.

SEMINAR ON THE APPLICATION OF LIGHT AND RADIO RANGE FINDERS

V. N. Skavronskii 19 Aug. 1971 11 p Transl. into ENGLISH from Geodez. i Kartograf. (Moscow), no. 3, 1971 p 74-77
(AD-733612; FSTC-HT-23-1318-71) Avail: NTIS CSCL 08/5

The contemporary status and prospects for development of light and radio range finders were discussed. The experience gained in using these devices in topographic-geodesic and engineering prospecting work, scientific research operations directed toward increasing the accuracy of measurement of line lengths by electronic devices was discussed also. Author (GRA)

N72-18398# Institute for Defense Analyses, Arlington, Va. Science and Technology Div.

SOLAR FLUX, AND TOTAL PARTICLE AND O2 DENSITY, IN UPPER ATMOSPHERE

Alan J. Grobecker Sep. 1971 94 p refs
(Contract DAHC15-67-C-0011)
(AD-733662; P-695; IDA/HQ-70-11860) Avail: NTIS CSCL 04/1

Solar flux, and total particle and O2 density distribution, in the upper mesosphere and lower thermosphere (70- to 150-km region) are described. Respective distributions were determined from solar flux intensities measured by ion chambers in three rocket vehicles launched on 21 February 1966 from North America (two at Eglin Gulf Test Range, Florida, and one at Fort Churchill, Manitoba). Method of determining density distributions is given. Solar flux outside and inside the absorbing atmosphere was measured for the following wave bands: 1-20A (X-ray), 1140-1260A (mainly hydrogen Lyman-alpha line at 1215.6A), and 1325-1475A (Schumann-Runge continuum). Distributions of O2 and total particle density are based on the solar flux absorption in the sensible atmosphere. Results of solar flux measurements compare, in general, with results obtained elsewhere. Estimated errors vary from 10 to 100 percent. Density results also agree generally with those or other experimenters (using similar of other techniques), except for one striking difference: a step of O2 density exists at 113 plus or minus 7 km altitudes. This step, which to our knowledge has not been reported elsewhere, is described theoretically. Its existence is also confirmed by electron density data derived by ionosonde at each launch site. Author (GRA)

N72-18399# Naval Research Lab., Washington, D.C.
THREE DIMENSIONAL SCATTERED FIELDS FROM THE OCEAN BOTTOM
Kenneth D. Flowers, Burton G. Hurdle, and Kingsley P. Thompson
5 Nov. 1971 24 p refs
(RF Proj. 101-03-44-4059; SF Proj. 101-03-15-8181; SF Proj. 11-552-006-14317; SF Proj. 11-552-001-8181)
(AD-733651; NRL-7325) Avail: NTIS CSCL 20/1

An experiment to determine the three-dimensional acoustic field scattered from the sea bottom was conducted in the Blake Plateau. Pulsed 19.5-kHz transmissions were directed toward the bottom from a submarine as it approached and passed three special radio sono-buoys. The buoys were spaced to provide the maximum coverage of the scatter field in the half space above the bottom. Reception was made at each of the three buoys and at the source transducer. Sets of data were taken with the axis of the 8 degrees source beam depressed at angles between 15 and 90 degrees. The data were analyzed on the basis of an isotropic scatter model. Results of the spatial field were plotted in polar form, in terms of the mean scattering strength. When integration over the scattered field is performed, the ratio of power scattered from the bottom to incident power is unusual in that it is low at both low and high incident angles. The experiment resulted in the most comprehensive set of measurements of the bottom scattered field yet obtained.
Author (GRA)

N72-18400# TRW Systems Group, Redondo Beach, Calif.
OPTICAL TRANSMISSION ACROSS A ROUGH SURFACE Technical Report, 1 Mar. - 31 Jul. 1971
Philip J. Lynch and Richard J. Wagner Nov. 1971 60 p refs
(Contract N00014-71-C-0240; NR Proj. 387-051)
(AD-733749; TRW-17608-6003-R0-00) Avail: NTIS CSCL 08/10

A ray theory for the transmission of light across a randomly rough surface is formulated. Multiple-scatter and shadowing effects are accounted for in a consistent way. The illumination probabilities for the transmission problem are derived in a nontrivial extension of current shadowing theory. The direct transmission term and the two main higher-order corrections are specified in complete detail for a normally distributed boundary. The application of transmission theory to a quantitative description of sea color is considered.
Author (GRA)

N72-18401# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
THE L-PARAMETER, A NEW APPROXIMATION
Henry H. Hilton 15 Sep. 1971 16 p refs
(Contract F04701-71-C-0172)
(AD-733718; TR-0172(2260-20)-2; SAMSO-TR-71-263) Avail: NTIS CSCL 08/14

McIlwain defined the magnetic shell parameter L for a point in the earth's magnetic field by the equation L cubed B/M = F(I cubed B/M), where I is the integral invariant, B the mirror point field, M the earth's dipole moment, and F a function calculated for a dipole field. A new approximation to F has been found and is: L cubed B/M = 1 + (a sub 1)(cube root of X) + (a sub 2)(cube root of X sq) + (a sub 3)X where X = I cubed B/M, a sub 1 = 1.35047, a sub 2 = 0.465376, and a sub 3 = 0.0475455. The error in the determination of L is less than 0.01% for all L. The formula is asymptotically correct for X << 1 and X>> 1.
Author (GRA)

N72-18402# Aerospace Corp., El Segundo, Calif. Space Physics Lab.
DRIFT-SHELL SPLITTING AT ARBITRARY PITCH ANGLE
Michael Schulz 15 Nov. 1971 44 p refs
(Contract F04701-71-C-0172)
(AD-733717; TR-0172(2260-20)-8; SAMSO-TR-71-256) Avail: NTIS CSCL 04/1

Analytical expressions are developed to approximate the bounce period and second invariant as functions of particle energy, equatorial pitch angle, and parameters of the guiding field line. The equatorial pitch angle is not restricted to values near pi/2, as in the harmonic-oscillator approximation, but terms indicating deviation of the magnetic field from that of a dipole are included to first order only. There follow approximate analytical expressions for tracing drift shells in the magnetosphere. Two important cases are considered separately: (a) shell splitting caused by dawn-dusk asymmetry of the magnetosphere's electrostatic potential, superimposed on a dipolar magnetic field, and (b) shell splitting caused by day-night asymmetry of the earth's magnetic field in the absence of electric fields. In each case an expression is derived for the relationship between pitch-angle diffusion and radial diffusion in the presence of drift-shell splitting at arbitrary equatorial pitch angle.
Author (GRA)

N72-18403# Johns Hopkins Univ., Baltimore, Md. Chesapeake Bay Inst.
RESULTS OF A FIELD STUDY USING THE 3-AXIS DOPPLER SHIFT CURRENT METER
R. C. Seitz Sep. 1971 92 p refs
(Contract N00014-67-A-0163-0006; NR Proj. 083-016)
(AD-732436; Ref-71-6; TR-72) Avail: NTIS CSCL 08/10

During the spring of 1967 a field study with the 3-axis Doppler shift (acoustic) current meter was carried out in the Patuxent Estuary. The study, extending over a period of 18 days, obtained continuous measurements of 3-dimensional water velocities in fields of naturally occurring turbulence as these fields were convected past the Doppler meter which was mounted on a fixed tower in the estuary. These measurements with the Doppler meter were supplemented with a large amount of auxiliary data concerning the vertical structure of temperature, salinity, and currents in the estuary, continuous wind speed and direction measurements, and in some instances surface wave measurements. This report deals with the results of analyzing part of this set of data.
Author (GRA)

N72-18404# Pacific Missile Range, Point Mugu, Calif.
TIDAL AND LUNAR DATA FOR POINT MUGU, SAN NICOLAS ISLAND, AND THE BARKING SANDS AREA DURING 1972
Robert Deviolini 20 Nov. 1971 60 p ref
(AD-732447; PMR-TP-71-4) Avail: NTIS CSCL 08/3

Basic lunar and tidal data for Point Mugu, San Nicolas Island, and the Barking Sands area during 1972 are provided. The data presented are (1) tidal data; (2) times of moonrise and moonset; and (3) times of lunar phases.
Author (GRA)

N72-18405# Cornell Univ., Ithaca, N.Y. Dept. of Theoretical and Applied Mechanics.
ANALYSIS OF GROUND WAVE PROPAGATION IN LAYERED MEDIA Final Report
Yih-Hsing Pao, Ralph R. Gajewski, and Stephen A. Thau (Ill. Inst. of Tech., Chicago) Feb. 1971 150 p refs
(Contract DASA01-68-C-0004)
(AD-731398; DASA-2697) Avail: NTIS CSCL 08/11

The propagation of elastic waves in a multilayered geological environment is analyzed based on the theory of generalized-rays and the method of Lamb-Cagniard-Pekeris. The waves are generated by an underground explosion which is approximated by a point source. Velocity responses at receivers at ranges about one to three times the thickness of the source layer are calculated with a new computer code. The results are exact within the framework of the theory of elastic waves. Comparisons of the calculated results with the observations made at the Nevada Test Site in 1966 show considerable discrepencies.
Author (GRA)

N72-18406# RAND Corp., Santa Monica, Calif.
PROJECTION AND DISTRIBUTION OF WASTE THERMAL ENERGY
S. M. Greenfields Dec. 1970 7 p
(AD-731259; P-4540) Avail: NTIS CSCL 13/2

The world estimate of total thermal energy available as waste heat for the environment is given, and is at best, crude. The crudeness is based on several factors, but foremost is the lack of ability to accurately project the future demands for energy in a manner that takes into account the factors involved. The problems and errors of the forecast are discussed. GRA

N72-18407# New York Univ., N.Y. Geophysical Sciences Lab.
AN EVALUATION OF STOKES VELOCITIES AND INERTIA CURRENTS GENERATED BY DEEP-WATER SURFACE GRAVITY WAVES
Hong Chin Oct. 1971 91 p refs
(Contract N00014-67-A-0467-0022)
(AD-732779; GSL-TR-71-11) Avail: NTIS CSCL 08/3

A system for evaluating the horizontal motions induced by deep-water surface gravity waves is developed for a three-dimensional rotating ocean. The effects of secondary vorticity as well as the associated volume transports, variations with depth, depths of influence and vertical velocities due to horizontal convergences and divergences are considered. The application of this system to hindcasted, directional-frequency spectra of wave elevation in the North Atlantic shows that when waves are in a transient state, a Stokes current is generated that is capable of explaining a number of features of oceanic current variability. On longer time scales, a rotary current is generated that is shown to be capable of acting as a possible random source for simulating observations of inertial oscillations in the open sea. Author (GRA)

N72-18408# Naval Postgraduate School, Monterey, Calif.
STUDY OF THE NEAR SHORE SURFACE CHARACTERISTICS OF WINDROWS AND LANGMUIR CIRCULATION IN MONTEREY BAY M.S. Thesis
Alexander Maratos Sep. 1971 71 p refs
(AD-733197) Avail: NTIS CSCL 08/3

Observations of the spacing and angle of windrows with respect to the wind speed and direction were conducted in Monterey Bay, using aerial photographs taken of windrow accumulations on 13, 20, 27 April and 3, 11 May 1971. The spacing of windrows was found to depend upon wind speed. These windrows are indicative of the presence of helical vortices in the surface waters, and the data support Langmuir's contention that the vortices are wind-driven. Deflection angles showed small variation to the left and right of the wind with 0 degrees being the most common angle. No correlation was found between depth of the thermocline and row spacing. Author (GRA)

N72-18409# Naval Oceanographic Office, Washington, D.C.
THE SOUND VELOCITY STRUCTURE OF THE NORTH ATLANTIC OCEAN
Don F. Fenner and Paul J. Bucca Nov. 1971 91 p refs
(AD-733990; NOO-IR-71-13) Avail: NTIS CSCL 20/1

All available sound velocity data in the North Atlantic Ocean between 15 degrees and 65 degrees N. latitude and east of 65 degrees W. longitude (excluding the Labrador Sea) have been analyzed in terms of the seasonal areal extent and average axial depth of the upper sound channel, the annual areal extent and average depth of the subsurface sound velocity maximum, and the annual average depth of the deep sound channel axis. The vertical extent of these and other sound velocity structures are shown on nine north-south and nine east-west sound velocity cross-sections that extend to a maximum depth of 5000 meters. These cross sections include four winter/summer pairs along the same meridian and three winter/summer pairs along the same parallel. In addition, sound velocity/temperature-salinity comparisons for winter and summer are given for 50 locations throughout the North Atlantic Ocean. Author (GRA)

N72-18410# National Bureau of Standards, Washington, D.C. Building Research Div.
EARTH TEMPERATURES BENEATH FIVE DIFFERENT SURFACES Final Report, Mar. 1969 - Feb. 1970
T. Kusuda 1 Feb. 1971 149 p refs
(OCD Order DAH20-68-W-0106; NBS Proj. 4212436)
(AD-733944; NBS-10373; NBS-42; OCD-1211A) Avail: NTIS CSCL 08/13

The report covers the experimental effort of measuring, processing and analyzing earth temperature data beneath five different surfaces. Since the instrumentation and data processing phases of the endeavor have been described in the previous NBS Report 10223 entitled 'Automated Earth Temperature Station', only the analysis of the data is given in this report. Annual and typical daily plots of earth temperature under black, white, bare, short grass, and long grass surfaces are presented together with the surface weather conditions and soil moisture content. Author (GRA)

14 INSTRUMENTATION AND PHOTOGRAPHY

Includes design, installation, and testing of instrumentation systems; gyroscopes; measuring instruments and gages; recorders; transducers; aerial photography; and telescopes and cameras.

N72-18411* National Aeronautics and Space Administration. John F. Kennedy Space Center, Cocoa Beach, Fla.
HIGH SPEED PHOTO-OPTICAL TIME RECORDING Patent
Jesse T. Copeland, Jr., inventor (to NASA) Issued 7 Sep. 1971 4 p Filed 31 Dec. 1969 Supersedes N70-35415 (08 - 19, p 3539)
(NASA-Case-KSC-10294; US-patent-3,603,974; US-Patent-Appl-SN-889556; US-Patent-Class-346-23; US-Patent-Class-346-107A; US-Patent-Class-307-311; US-Patent-Class-352-84; US-Patent-Class-95-1.1) Avail: US Patent Office CSCL 14E

An apparatus is described for placing a permanent time record on photographic film while being used in a high speed movie camera to indicate the exact time each frame of film is exposed. A coded source of timing pulses is fed into an electronic circuit that includes an electroluminescent diode that generates light signals corresponding to the timing pulses. These light signals are placed on the film in the camera. Official Gazette of the U.S. Patent Office

N72-18412# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
DIRECTIONAL SOLID STATE DETECTOR FOR MEASURING PROTONS BETWEEN 1 AND 8 MeV FOR USE ON ROCKETS [DETECTOR DE ESTADO SOLIDO DIRECCIONAL PARAMEDICION DE PROTONES DE ENERGIAS COMPRENDIDAS ENTRE 1 MeV Y 8 MeV, A SER UBICADO EN LA CARGA UTIL DE UN CO HETE DRAGON]
J. R. Manzano and O. R. Santochi 1969 22 p refs In SPANISH
(Rept-8) Avail: NTIS

Preliminary work on the design and construction of a proton detector is presented. The semiconductor device works in a manner similar to that of an ionization camera. Signals are produced by free charges during absorption. The theory of its operation and a mechanical description are given. The electronic circuits are discussed and a number of schematics are included. Transl. by K.P.D.

N72-18413# Comision Nacional de Investigaciones Espaciales, Buenos Aires (Argentina).
REPORT OF THE STUDY AND DEVELOPMENT OF SENSORS FOR MEASURING PRECIPITATION PROTONS AND ELECTRONS AND X-RAYS IN THE SOUTH AMERICAN ANOMALIES BY MEANS OF ROCKET

TRANSPORTED INSTRUMENTS [REALIZACION DEL ESTUDIO Y DESARROLLO DE SENSORES PARA LA MEDICION DE PROTONES Y ELECTRONES DE PRECIPITACION Y RAYOS X EN LA ANOMALIA SUDAMERICANA MEDIANTE INSTRUMENTAL TRANSPORTADO EN COHETES]
J. R. Manzano and O. R. Santochi 1969 32 p refs In SPANISH
(Rept-7) Avail: NTIS

A six-channel X-ray spectrometer was designed and constructed for measuring the spectra of photons produced by electrons emitted from an internal radiation ring. This instrument permits the evaluation of the various parameters of a theoretical model. The Arcas rocket, originally designed for meteorological investigations, is described. It is capable of transporting a useful cargo weighing 4.5 kg to an altitude of 60 km. Transl. by K.P.D.

N72-18414# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
A STUDY OF THE ACCURACY OBTAINED WITH THE ELECTROMAGNETIC DISTANCE MEASURING APPARATUS TELLUROMETER MRA 101, VOLUME A AND VOLUME B M.S. Thesis
I. Kolliopoulos, A. Bozopoulos, A. Chaliasos, and E. Chrysaphes 1970 509 p In GREEK 2 Vol.
Avail: NTIS HC $6.00/MF $0.95

The tellurometer MRA 101 is evaluated for accuracy in measuring distances under different meteorological conditions. All supporting apparatus for the tellurometer's successful operation are enumerated and their auxillary devices are described. Complete and detailed instructions for setting up and operating the instrument are presented. The manner in which data should be obtained is described as well as meteorological conditions and how they affect the instruments operation. Actual field data and supporting sinusoidal diagrams are given, along with information on how actual field data should be corrected. Two main sources of error are the zero correction of the instrument itself and the index of refraction of the air. The accuracy of the instrument and how the latter varies with changing temperature, atmospheric pressure, and humidity are studied. Author

N72-18415*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 13 LUNAR PHOTOGRAPHY
A. T. Anderson, C. K. Michlovitz, and K. Hug Natl. Space Science Data Center Dec. 1970 172 p refs
(NASA-TM-X-68812; NSSDC-70-18) Avail: NTIS CSCL 14E

A data users' note announces the availability of Apollo 13 pictorial data and aids the investigator in the selection of Apollo 13 photographs for study. This note provides guidance in the interpretation of the photographs. The note includes brief descriptions of the Apollo 13 mission objectives, photographic equipment, and photographic coverage and quality. The National Space Science Data Center (NSSDC) can provide all forms of the photographs described. Author

N72-18416*+ National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO MISSION 14 LUNAR PHOTOGRAPHY INDEXES
Jun. 1971 54 p Prepared in cooperation with Aeron. Chart and Inform. Center
(NASA-TM-X-68814) Avail: NTIS CSCL 14E

An index of lunar photography taken during the Apollo 14 mission is presented. Prominent lunar topographical features are identified. A grid is superimposed on the photographs to establish the coordinates of lunar features. P.N.F.

N72-18417*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 14 LUNAR PHOTOGRAPHY. PART 1: DATA USER'S NOTE
A. T. Anderson and M. A. Niksch Natl. Space Science Data Center Aug. 1971 30 p refs
(NASA-TM-X-68813; NSSDC-71-61a) Avail: NTIS CSCL 14E

The availability of Apollo 14 pictorial data is announced to aid investigators in the selection of Apollo 14 photographs for study. Guidance in the interpretation of the photographs is provided. As background information, the note includes brief descriptions of the Apollo 14 mission objectives, photographic equipment, and photographic coverage and quality. The National Space Science Data Center (NSSDC) can provide the photographs described. Author

N72-18418*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 11 LUNAR PHOTOGRAPHY
A. T. Anderson, C. K. Michlovitz, and K. Hug Apr. 1970 22 p refs
(NASA-TM-X-68802; NSSDC-70-06) Avail: NTIS CSCL 14E

A data user's note is presented which announces the availability of the complete set of Apollo 11 pictorial data and aids investigators in the selection of Apollo 11 photographs for study. In addition, this note provides guidance in the interpretation of the photographs. As background information, brief descriptions of the Apollo 11 mission objectives, photographic equipment, and photographic coverage and quality are included. The National Space Science Data Center (NSSDC) can provide all forms of photographs described in the section on format of available data. Author

N72-18419*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
APOLLO 11 70-mm PHOTOGRAPHIC CATALOG
Apr. 1970 252 p
(NASA-TM-X-68803; NSSDC-70-07) Avail: NTIS CSCL 14E

Proof prints of virtually all the 70-mm photography exposed during the Apollo 11 mission are presented. The photography has been sorted by magazine and by frame number. The numbering scheme used throughout all Apollo mission is described. The catalog is designed to be used in conjunction with the section on 70-mm photography in Apollo 11 Photography: 70-mm, 16-mm, and 35-mm Frame Index, which provides pertinent information on each frame, and with Apollo Mission 11 Lunar Photography Indexes, which makes it possible to locate the area covered by each frame. Author

N72-18420*+ National Aeronautics and Space Administration, Washington, D.C.
APOLLO MISSION 11 PHOTOGRAPHY INDEXES
Oct. 1969 36 p Prepared in cooperation with Aeron. Chart and Inform. Center
(NASA-TM-X-68804) Avail: NTIS CSCL 14E

The lunar photography indexes include: (1) targets of opportunity - 70 mm (color), (2) targets of opportunity - 70 mm (black and white), and (3) sequence photography - 16 mm (color). The photography is identified as having been taken from the lunar module or from the command service module. D.L.G.

N72-18421*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 11 PHOTOGRAPHY 70-mm, 16-mm, AND 35-mm INDEX
Natl. Space Science Data Center Feb. 1971 131 p refs
(NASA-TM-X-68805) Avail: NTIS CSCL 14E

A catalog of photographs taken during the Apollo 11 mission is presented. Photographs were taken with the Hasselblad 70 millimeter camera. Magazine N consists of 141 frames of color film. The major number of frames are of the translunar phase of the mission, with photographs of the earth, capsule interiors, and operational photographs. The last 28 frames of the magazine contain photographs of the lunar surface. Author

N72-18422*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
DATA USER'S NOTE: MARINER 6 AND 7 PHOTOGRAPHIC DATA (NSSDC ID NO. 69-014A-01 AND 69-030A-01
A. T. Anderson and M. A. Beeler Mar. 1971 315 p refs
(NASA-TM-X-68806; NSSDC-71-09) Avail: NTIS CSCL 14E

The availability and assistance in the use of the complete set of Mariner 6 and 7 (1969 14A and 1969 20A) pictorial data are announced. The announcement describes the photographic mission of these Mariner spacecrafts, the television camera system, and the photographs that are available from the National Space Data Center. Two appendixes are included: one is a photographic catalog of all enhanced photographs, designated the maximum discriminability photographs; the other is a series of computer produced graphics that are useful in detailed analysis of the photographs. Author

N72-18423*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO MISSION 12 LUNAR PHOTOGRAPHY INDEXES
Mar. 1970 36 p Prepared in cooperation with Aeron. Chart and Inform. Center
(NASA-TM-X-68809) Avail: NTIS CSCL 14E

An index of lunar photography taken during the Apollo 12 mission is presented. Prominent lunar features are identified and named. A superimposed grid provides coordinate location for lunar topographical features. The photographs are of targets of opportunity taken with a 70 millimeter camera. P.N.F.

N72-18424*# Mississippi State Univ., State College. Dept. of Aerophysics and Aerospace Engineering.
A CATALOGUE OF DEVICES APPLICABLE TO THE MEASUREMENT OF BOUNDARY LAYERS AND WAKES ON FLIGHT VEHICLES
Stan J. Miley Jan. 1972 134 p refs
(Grant NGR-25-001-036)
(NASA-CR-116776; AASE-71-51) Avail: NTIS CSCL 14B

A literature search was conducted to assemble a catalog of devices and techniques which have possible application to boundary layer and wake measurements on flight vehicles. The indices used in the search were NACA, NASA STAR, IAA, USGRDR and Applied Science and Technology Index. The period covered was 1950 through 1970. The devices contained in the catalog were restricted to those that provided essentially direct measurement of velocities, pressures and shear stresses. Pertinent material was included in the catalog if it contained either an adequate description of a device and associated performance data or a presentation of applicable information on a particular measurement theory and/or technique. When available, illustrations showing the configuration of the device and test condition data were also included. Author

N72-18425*# National Research Corp., Cambridge, Mass.
WIND TUNNEL MASS SPECTROMETER DESIGN STUDY Final Report
J. E. Hueser and P. Fowler 1971 97 p refs
(Contract NAS1-8223-6)
(NASA-CR-111986) Avail: NTIS CSCL 14B

The sampling probe to measure the free stream gas composition in a hypersonic wind tunnel is described. Using a free expansion of the continuum flow, a series of sampling inlet-pumping stages is evaluated. Mass analysis is carried out with a quadrupole mass spectrometer employing a crossed electron beam, molecular beam ion source, and an off-axis electron multiplier. The spatial distribution of the sampled molecular flux and the pumping requirements are evaluated for varying inlet conditions of gas density and flow velocity. The signal-to-noise ratio of the molecular beam formed by this series of coaxial inlets is also determined. The signal-to-noise ratio of the unscattered flux is sufficiently high that an unambiguous determination of the beam composition and of the free stream gas properties can be made. The magnitude of the detected signal is sufficiently high that measurement of trace constituents two orders of magnitude below the primary beam signal can be made. Author

N72-18426# National Aerospace Lab., Tokyo (Japan).
MEASUREMENT OF THREE-DIMENSIONAL MEAN VELOCITY VECTOR AND REYNOLDS STRESS BY A SINGLE ROTATABLE HOT WIRE
Yoshio Hayashi and Teruomi Nakaya Jul. 1971 13 p refs In JAPANESE; ENGLISH summary
(NAL-TR-242) Avail: NTIS

A practical method of measuring three-dimensional mean-velocity components and six components of Reynolds stress, by means of a hot-wire anemometer of constant-current operation, with a single hot-wire fixed on a rotatable support, is presented together with experimental results. The hot-wire probe is brought to a certain angular position, rotated around its axis by means an electric servo-mechanism and the linearized output signal of the anemometer is measured by a dc voltmeter and a RMS meter. The above procedure is repeated at several angles of the probe axis for each measured point. The three mean-velocity components can be obtained from the measured values of d.c. output and the rotational angles of hot-wire probe, by solving the simultaneous quadratic equations by the least squares method and the Newton-Raphson method. On the other hand, the Reynolds stress can be obtained from the measured values of the RMS meter output and the angles of the hot-wire probe, using the least squares method and the matrix method. Author

N72-18427*# Develco, Inc., Mountain View, Calif.
SUPERCONDUCTING ROCK MAGNETOMETER SYSTEM Final Engineering Report
14 Jan. 1972 15 p
(Contract NAS9-11523)
(NASA-CR-115419) Avail: NTIS CSCL 14B

A three axis magnetometer system intended for use in the magnetic measurement of lunar rock samples was designed, fabricated and delivered to NASA Manned Spacecraft Center. The system has a four inch diameter room temperature sample access region and is fitted with three orthogonal magnetic field sensors enclosing this region. Two superconducting magnetic shields are incorporated, which are designed to eliminate external magnetic noise from the sense coils. A superconducting solenoid is mounted coaxially with the sample region and this provides axial magnetic fields up to 1,000 gauss. The system was designed for measuring magnetic moments of geophysical samples, especially remanent moments of lunar samples. The sensitivity of the system in all three axes is about 2 x 10 to the -7th power EMU square root HZ peak to peak, measured in the 0 to 1 Hz bandwidth. Author

N72-18428# Academy of Sciences (USSR), Moscow.
RADIOPHYSICAL METHODS FOR INFRARED DETECTION
G. P. Arumov and V. S. Etkin 1971 66 p refs In RUSSIAN
(PR-69) Avail: NTIS

Three methods for the detection of infrared radiation are discussed: direct, heterodyne, and frequency conversion. These methods were applied to actual receivers. Sensitivity, pole frequency, and the ability to operate without deep condensation are considered. The study was restricted to the near and middle infrared regions. Transl. by K.P.D.

N72-18429# National Bureau of Standards, Boulder, Colo. Electromagnetics Div.
BOLOVAC SYSTEMS FOR MEASURING ELECTRICAL QUANTITIES FROM 0.5 MHz THROUGH MICROWAVES
Myron C. Selby Jan. 1972 24 p refs
(NBS-Monograph-123) Avail: SOD $0.30 as C 13.44:123

A novel device--the Bolovac--is employed in measurement systems that furnish known voltages and currents up to 18 GHz, remove serious difficulties in power measurements, and are applicable in impedance, attenuation and other measurements.

Typical of such measurements are the evaluation of rf power sources; calibration of power meters; measurement of net and incident power flow in a system; calibration of signal generators, voltmeters, current meters, picosecond-rise-time pulse-display oscilloscopes, spectrum analyzers; determination of insertion loss of components; and calibration of directional couplers. The Bolovac also serves as an accurately known resistive termination for match or mismatch applications from LF through microwaves.
Author

N72-18430*# Singer Co., Little Falls, N.J. Kearfott Div.
SKYLAB INDICATORS (EVENT TIMER) (SECONDARY DISPLAY) (FOUR-DIGIT METABOLIC DISPLAY) Final Report, Jun. 1970 - Nov. 1971
William Tiberg Nov. 1971 208 p refs
(Contract NAS8-26120)
(NASA-CR-123490; Y256A004) Avail: NTIS CSCL 14B

The effort expended in developing the following indicators is summarized: (1) event timer; (2) secondary display; and (3) 4 digit display (metabolic). The mechanical design, vibration analysis, and thermal analysis of all these units are identical, and descriptions pertain to all three units. All problems incurred during the program are discussed along with the recommendations, conclusions, and actions taken to rectify the situations. Author

N72-18431# Technische Hogeschool, Eindhoven (Netherlands).
SENSITIVE FORCE DETERMINATIONS AND SOME RELATED TOPICS Ph.D. Thesis
Carel Herman Massen 1971 96 p refs
Avail: NTIS

The study of chemical reaction processes by means of magnetic susceptibility measurements is reported. These were carried out with a microbalance which served for the detection of the forces involved in the application of the Faraday method. The design of the microbalance was such that it allowed the measurement of magnetic susceptibilities at temperatures ranging from room temperature to over 900 C. The balance work involved in these investigations initiated a more general contemplation of the various causes of inaccuracies which may be a measure for the sensitivity of force and mass determinations.
Author

N72-18432# National Bureau of Standards, Washington, D.C. Inst. for Applied Technology.
PRECISION MEASUREMENT AND CALIBRATION. VOLUME 7: RADIOMETRY AND PHOTOMETRY
Harry K. Hammond, III and Henry L. Mason, eds. Nov. 1971 671 p refs
(NBS-SP-30-Vol-7; LC-68-60042) Avail: SOD $7.00 as C 13.10:300/v.7

The development of accurate standards for radiometric and photometric calibration and measurements is described. They include emissivity, emittance, radiance, and irradiance standards as well as related measurement techniques, including reflectometry and laser radiometry. Photometric radiant flux measurements are weighted according to spectral sensitivity of the human eye. For individual titles, see N72-18433 through N72-18444.

N72-18433# National Bureau of Standards, Washington, D.C.
GENERAL RADIOMETRY
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 1-28 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Radiometric standards, sources, and detectors for radiation measurements are considered. The use of thermophiles for absolute radiometry in the far ultraviolet is outlined and a comparison of an ionization chamber and a thermophile as absolute detectors in the extreme ultraviolet is made. A simple equation is developed that gives at any wavelength, the ratio of the spectral radiances of two arbitrary sources when their spectral radiances at some particular wavelength are equal. G.G.

N72-18434# National Bureau of Standards, Washington, D.C.
EMISSIVITY STANDARDS
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 29-114 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Analytical expressions and radiation properties of conical, cylindrical, and cavity emission standards are discussed. The standards of normal spectral emission are intended for use in calibrating equipment for measuring properties of materials.
G.G.

N72-18435# National Bureau of Standards, Washington, D.C.
EMISSIVITY AND EMITTANCE MEASUREMENTS AND TECHNIQUES
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 115-217 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Equipment and procedures for standardized thermal emittance measurements on real metals, surface films, and ceramic oxide specimens are outlined. Infrared devices and computational methods of radiant heat transfer are emphasized.
G.G.

N72-18436# National Bureau of Standards, Washington, D.C.
MATERIAL PROPERTIES c23
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 219-262 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Thermal radiative properties of ceramic materials, coated and uncoated specimens of Inconel and stainless steels, and of metals are discussed. Also considered is the effect of surface roughness on emittance of nonmetals. G.G.

N72-18437# National Bureau of Standards, Washington, D.C.
IRRADIANCE STANDARDS c23
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 263-286 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Existing methods and instrumentations to produce tungsten filament and quartz iodine lamp standards for spectral and total irradiance measurements are reported. A tungsten strip lamp is especially useful in certain fields of extremely low irradiation such as is present in airglow and in phosphorescent, fluorescent, biochemical, and associated areas. A 1000-W tungsten halogen lamp-ceramic reflector combination with fused silica and alumina coated reflecting surface is able to measure the required irradiance of solar simulators. G.G.

N72-18438# National Bureau of Standards, Washington, D.C.
RADIOMETRIC MEASUREMENT TECHNIQUES
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 287-357 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Prisms and filter spectroradiometric techniques are used to determine spectral irradiances of solar simulators and weatherometers, as well as the spectral distribution of radiant energy from the sun in the ultraviolet region. Apparent variations in spectral and surface sensitivities of radiometric detectors as functions of wavelengths and irradiated areas require calibration against exact emission standards and uniform irradiation using flux mixing mechanisms. Pulsed laser outputs are measured by a radiometric method that employs a photoelectric receiver to compare the diffusely reflected entire laser beam to the calibrating source. Also discussed is a spatial mapping procedure to correct for scattering effects in radiant intensity measurements by the optical system used to transmit the radiation to the detector.
G.G.

N72-18439# National Bureau of Standards, Washington, D.C.
RADIANCE STANDARDS
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971

p 359-405 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

The construction and operation of standard black bodies and their use as spectral radiance sources for calibrating tungsten ribbon strip lamps, photoelectric pyrometers, and spectroradiometers are described. Detailed instructions for an inexpensive optical pyrometry copper-point black body and furnace that realize a radiance temperature of 1083.3 C are included. G.G.

N72-18440# National Bureau of Standards, Washington, D.C.
FLUX MEASUREMENT
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971
p 407-456 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Theory and construction of a reinforced concrete sphere as photometric standard, and application methods for an infrared integrating sulfur coating are discussed. Performance tests on infrared detectors show that the use of a small sulfur-coated hollow sphere over the detector increases the accuracy of most types of infrared reflectance measurements; such a modified thermopile extends the usefulness of a specular reflectometer to about 10 microns. G.G.

N72-18441# National Bureau of Standards, Washington, D.C.
REFLECTOMETRY
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971
p 457-509 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Theoretical and experimental work in reflectometry centered on integrating spheres and reflecting mirrors. The effects of surface texture on the diffuse spectral reflectance of metal surfaces and the use of high purity CsI as infrared reflective diffusers are studied. Preparation and colorimetric properties of a magnesium oxide diffusing surface as reflectance standard are described and preliminary data for laser source reflectometer measurements on thoria, tungsten, and graphite are reported. G.G.

N72-18442# National Bureau of Standards, Washington, D.C.
LASER RADIOMETRY c16
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971
p 511-521 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Calorimetric and radiometric instrumentation is described that is used to measure laser output energy. Several calorimeters having cone shaped absorption cells, differing absorbing liquids, and Brewster's angle inputs performed well with laser energies up to 200 megawatts; pulsed laser output measurements with different photoelectric receivers agreed to about 1.5% using a 1/4 joule pulsed laser as a source. Also described is a laser power meter that measures the flow of heat generated by the beam and is calibrated with an electrical heater wound just behind the abosrbing surface. G.G.

N72-18443# National Bureau of Standards, Washington, D.C.
GENERAL PHOTOMETRY
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971
p 523-576 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

Platinum blackbody radiators as standards of light, and electrical and photometric units for illumination engineering considerations are reported. Filters for the reproduction of sunlight and daylight and the determination of color temperatures are described, and the luminous efficiency of a physical photometer is compared to the accuracy of visual observations when the photometric fields are not color matched. Concepts, terminology, and notations for optical modulations and resources are included. G.G.

N72-18444# National Bureau of Standards, Washington, D.C.
APPLIED PHOTOMETRY
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971
p 577-656 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

A variety of methods and instruments are presented that encompass goniometers for projection photometry, searchlight projectors, measurements of discharge and flashing light intensities, low luminance photometry, filters in colored light photometry, and the design and performance of light scattering photometers. Theoretical calculations on luminous beam flux and flash light intensities are included. G.G.

N72-18445*# Bellcomm, Inc., Washington, D.C.
LUNAR SURFACE EVA PHOTOGRAPHY OF HADLEY RILLE: CONTRAST AS A CONSTRAINT
H. W. Radin 1 Feb. 1972 42 p
(Contract NASw-417)
(NASA-CR-125669; TM-72-2015-2) Avail: NTIS CSCL 14E

Prior to the Apollo 15 flight, preliminary plans for lunar surface EVA photography of Hadley Rille were examined from the standpoint of expected photographic contrast. Considerable variation in contrast was predicted, resulting in suggestions for specific targets either to be emphasized or ignored at various EVA photo stations. Apollo 15 surface EVA photography appears to have highly satisfactory contrast, generally confirming the predictions. The general technique can be applied to Apollo 16 and 17 photography. Author

N72-18446# National Center for Atmospheric Research, Boulder, Colo.
A PROTOTYPE OPTICAL FLOWMETER FOR THE MEASUREMENT OF LIQUID WATER CONTENT
E. N. Brown Sep. 1971 29 p refs Sponsored by NSF
(NCAR-TN/EDD-61) Avail: NTIS

Devices to measure liquid water content of clouds are considered. A paper conductometric device and a heated wire instrument are generally accepted by cloud physics research groups as operational instruments for airborne application. The design of a device is considered, for measuring liquid water content (for use on aircraft) and its performance is evaluated. Author

N72-18447*# Geological Survey, Menlo Park, Calif.
MULTISPECTRAL TECHNIQUES FOR GENERAL GEOLOGICAL SURVEYS EVALUATION OF A FOUR-BAND PHOTOGRAPHIC SYSTEM
Dwight Crowder, F. May 1969 14 p refs
(NASA Order R-090-020-011)
(NASA-CR-125641; USGS-IR-NASA-150) Avail: NTIS CSCL 14B

A general geological survey at 1:62,500 scale of the well exposed rocks of the White Mountains and the adjacent volcanic desert plateau is reported. The tuffs, granites, sedimentary rocks and metavolcanic rocks in this arid region are varicolored and conventional black and white aerial photographs have been a useful mapping aid. A large number of true color and false color aerial photographs and multispectral viewer screen images of the study area are evaluated in order to consider what imagery is the most useful for distinguishing rock types. Photographs of true color film are judged the most useful for recognizing geographic locations. Author

N72-18448*# Geological Survey, Washington, D.C.
THE FRAUNHOFER LINE DISCRIMINATOR: AN AIRBORNE FLUOROMETER
George E. Stoertz 1969 34 p refs
(NASA Order T-80485-C)
(NASA-CR-125643; USGS-IR-NASA-157) Avail: NTIS CSCL 14B

An experimental Fraunhofer Line Discriminator (FLD) can differentiate and measure solar-stimulated luminescence when viewed against a background of reflected light. Key elements are two extremely sensitive photomultipliers, two glass-spaced Fabry-Perot filters having a bandwidth less than 1 A, and an analog computer. As in conventional fluorometers, concentration of a fluorescent substance is measured by comparison with standards. Quantitative use is probably accurate only at low altitudes but detection of luminescent substances should be possible from any altitude. Applications of the present FLD include remote sensing of fluorescent dyes used in studies of current dynamics. The basic technique is applicable to detection of oil spills, monitoring of pollutants, and sensing over land areas. Author

N72-18449*# Geological Survey, Menlo Park, Calif.

EVALUATION OF NINE-FRAME ENHANCED MULTIBAND PHOTOGRAPHY SAN ANDREAS FAULT ZONE, CARRIZO PLAIN, CALIFORNIA

Robert E. Wallace [1969] 14 p Original contains color illustrations

(NASA Order R-09-020-011)

(NASA-CR-125633; USGS-IR-NASA-18) Avail: NTIS CSCL 14E

Nine-frame multiband aerial photography of a sample area 4500 feet on a side was processed to enhance spectral contrasts. The area concerned is in the Carrizo Plain, 45 miles west of Bakersfield, California, in sec. 29, T 31 S., R. 21 E., as shown on the Panorama Hills quadrangle topographic map published by the U. S. Geological Survey. The accompany illustrations include an index map showing the location of the Carrizo Plain area; a geologic map of the area based on field studies and examination of black and white aerial photographs; an enhanced multiband aerial photograph; an Aero Ektachrome photograph; black and white aerial photographs; and infrared image in the 8-13 micron band. Author

N72-18450*# Geological Survey, Washington, D.C.

TESTING THE FRAUNHOFER LINE DISCRIMINATOR BY SENSING FLUORESCENT DYE

George E. Stoertz 1969 53 p

(NASA Order T-80485)

(NASA-CR-125653; USGS-IR-NASA-159) Avail: NTIS CSCL 14B

The experimental Fraunhofer Line Discriminator (FLD) has detected increments of Rhodamine WT dye as small as 1 ppb in 1/2 meter depths. It can be inferred that increments considerably smaller than 1 ppb will be detectable in depths considerably greater than 1/2 meter. Turbidity of the water drastically reduces luminescence or even completely blocks the transmission of detectable luminescence to the FLD. Attenuation of light within the water by turbidity and by the dye itself are the major factors to be considered in interpreting FLD records and in relating luminescence coefficient to dye concentration. An airborne test in an H-19 helicopter established feasibility of operating the FLD from the aircraft power supply, and established that the rotor blades do not visibly affect the monitoring of incident solar radiation. Author

N72-18451*# Geological Survey, Washington, D.C.

FRAUNHOFER LINE-DEPT SENSING APPLIED TO WATER

George E. Stoertz 1969 51 p refs

(NASA Order T-80485-C)

(NASA-CR-125654; USGS-IR-NASA-158) Avail: NTIS CSCL 14B

An experimental Fraunhofer line discriminator is basically an airborne fluorometer, capable of quantitatively measuring the concentration of fluorescent substances dissolved in water. It must be calibrated against standards and supplemented by ground-truth data on turbidity and on approximate vertical distribution of the fluorescent substance. Quantitative use requires that it be known in advance what substance is the source of the luminescence emission; qualitative sensing, or detection of luminescence is also possible. The two approaches are fundamentally different, having different purposes, different applications, and different instruments. When used for sensing of Rhodamine WT dye in coastal waters and estuaries, the FLD is sensing in the spectral region permitting nearly maximum depth of light penetration. Author

N72-18452*# Geological Survey, Menlo Park, Calif.

EVALUATION OF COLOR AND COLOR INFRARED PHOTOGRAPHY FROM THE GOLDFIELD MINING DISTRICT, ESMERELDA AND NYE COUNTRIES, NEVADA

Roger P. Ashley Mar. 1970 56 p refs Original contains color illustrations

(NASA Order R-09-020-015)

(NASA-CR-125655; USGS-IR-NASA-176) Avail: NTIS CSCL 14E

The determination of geological features characteristic of the Goldfield epithermal ore deposits is considered and which of them can be identified from color and color infrared aerial photography. The Goldfield mining district in the western part of the Basin and Range Province is the area of study, located in desert terrain of relatively low relief. Author

N72-18453*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

INVESTIGATION OF AN ELECTRONIC IMAGE ENHANCER FOR RADIOGRAPHS

Alex Vary 1972 18 p refs Presented at Spring Conf. of Am. Soc. for Nondestructive Testing, Los Angeles, 13-16 Mar. 1972

(NASA-TM-X-68025; E-6831) Avail: NTIS CSCL 14B

Radiographs of nuclear and aerospace components were studied with a closed-circuit television system to determine the advantages of electronic enhancement in radiographic nondestructive evaluation. The radiographic images were examined on a television monitor under various degrees of magnification and enhancement. The enhancement was accomplished by generating a video signal whose amplitude is proportional to the rate of change of density. Points, lines, edges, and other density variations that are faintly registered in the original image are rendered in sharp relief. Examples of the applications of this mode of enhancement are discussed together with the system's dynamic response and resolution. Author

N72-18454*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LUNAR SURFACE CLOSEUP STEREOSCOPIC PHOTOGRAPHY AT FRA MAURO (APOLLO 14 SITE)

W. David Carrier, III and Grant Heiken Jan. 1972 52 p refs

(NASA-TM-X-58072) Avail: NTIS CSCL 14E

A total of 17-1/2 stereopairs of lunar surface rocks and soil was taken on the Apollo 14 mission. The closeup stereopair photographs are presented with a preliminary interpretation for those interested in lunar soil formation, impact phenomena, and soil mechanics. Author

N72-18455*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.

ESTIMATING OPTICAL IMAGING SYSTEM PERFORMANCE FOR SPACE APPLICATIONS

Kenneth F. Sinclair Washington Feb. 1972 32 p refs

(NASA-TM-X-62139) Avail: NTIS CSCL 20A

The critical system elements of an optical imaging system are identified and a method for an initial assessment of system performance is presented. A generalized imaging system is defined. A system analysis is considered, followed by a component analysis. An example of the method is given using a film imaging system. Author

N72-18456*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Guidance and Control Div.

THE RESPONSE OF COVERED SILICON DETECTORS TO MONOENERGETIC GAMMA RAYS

Melvin Reier 15 Jan. 1972 20 p refs

(Contract NAS7-100)
(JPL-TM-33-524; NASA-CR-125679) Avail: NTIS CSCL 18B

Measurements were made of the efficiency in detecting gamma rays of a 0.3-mm, a 3-mm, and a 5-mm silicon detector covered with different absorbers. Calibrated sources covering the range from 279 KeV to 2.75 MeV were used. The need for the absorbers in order to obtain meaningful results, and their contribution to detector response at electron biases from 50 to 200 KeV, are discussed in detail. It is shown that the results are independent of the atomic number of the absorber. In addition, the role of the absorber in increasing the efficiency with increasing photon energy for low bias setting is demonstrated for the 0.3-mm crystal. Qualitative explanations are given for the shapes of all curves of efficiency versus energy at each bias.
Author

N72-18457# Oklahoma Univ., Norman. Dept. of Meteorology.
PRELIMINARY REPORT ON THE FEASIBILITY STUDY OF MESO-MICROMETEOROLOGICAL INTERACTION WITH SONIC ANEMOMETER-THERMOMETERS INSTALLED AT THE WKY-TV TOWER
Ken Sahashi Jan. 1972 22 p refs
(Grants NOAA-N22-47-72(G); ESSA-E22-17-69(G))
(OURI-1828-72-1) Avail: NTIS

During the Spring storm season of 1969, two one dimensional sonic anemometer-thermometers were installed on a tower at the heights of 177 m and 44 m above the ground. The purpose of this observation was to find the microstructure of the turbulence during Spring storms in the Oklahoma area, and to find the micro-meteorological characteristics under clear weather conditions. As a result of the preliminary analysis, it is shown there exists a difference between the pre-storm period and the storm period in the spectral distribution of the vertical component of wind velocity. It is further found that nearly vertical air motion is associated with a thunderstorm meso-cyclone. Author

N72-18458*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
USE OF A SPACECRAFT BORNE ALTIMETER FOR DETERMINING THE MEAN SEA SURFACE AND THE GEOPOTENTIAL
W. D. Kahn and J. W. Bryan Jan. 1972 30 p refs
(NASA-TM-X-65830; X-550-72-19) Avail: NTIS CSCL 14B

An experiment is proposed to test a first generation spacecraft-borne radar altimeter's capability to measure the topography of the sea surface. The initial radar altimeter will have an instrumental error of one meter and an overall accuracy to two to five meters. This instrument will thus improve the accuracy of the geoid from the present 10 to 20 meters to better than 5 meters. In order to detect storm surges, tidal forces, and ocean currents, an altimeter with an overall accuracy of at least ±1 meter will be required. The overall accuracy of the initial radar altimeter will thus primarily provide geodetic information and possible oceanographic information such as sea state. Author

N72-18459# Stanford Research Inst., Menlo Park, Calif.
CALIBRATION AND CHARACTERIZATION OF YTTERBIUM STRESS TRANSDUCERS, TASK 3 Final Report
Michael J. Ginsberg Oct. 1971 53 p refs
(Contract DASA01-69-c-0014; ARPA Order 1238)
(AD-732778; DNA-2742F) Avail: NTIS CSCL 14/2

A series of experiments at stress levels up to 7.8 kbar were performed to determine the resistance change at peak dynamic stress of four-terminal gages fabricated from ytterbium foil and encapsulated in plexiglas. Four different lots of 99.9% pure ytterbium obtained from a single supplier were used in the experiments. Results are discussed. Author (GRA)

N72-18460# Aerospace Corp., El Segundo, Calif. Lab. Operations.
HIGH-TEMPERATURE MASS SPECTROMETRY. VOLUME 2: KNUDSEN CELL ASSEMBLY FOR HERZOG-MATTAUCH TYPE MASS SPECTROMETER
Francis M. Wachi, Donald E. Gilmartin, and Donald A. Roux 15 Sep. 1971 31 p refs
(Contract F04701-71-C-0172)
(AD-732857; TR-0200(4250-40)-6-Vol-2; SAMSO-TR-71-231-Vol-2) Avail: NTIS CSCL 14/2

A Knudsen cell assembly that is capable of operating up to 2750 K for use with the high-resolution Herzog-Mattauch type double-focusing mass spectrometer is described. The design of this Knudsen cell assembly is unusual, because the effusing orifice is situated on the curved side of the cylindrical cell and produces a molecular beam coaxial with the ion beam. The performance of this device was checked by measuring the heats of vaporization of silver and carbon. The third-law and second-law heat of sublimation of silver was measured. Both of these heats of sublimation are in agreement with those reported in the literature. Author (GRA)

N72-18461# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
PARTICLE SIZE ANALYSIS BY SEDIMENTATION Final Report
William Shelnutt Aug. 1971 114 p refs
(AF Proj. 7116)
(AD-733324; ARL-71-0134) Avail: NTIS CSCL 14/2

Two methods of determining the size distribution of very fine powders by sedimentation in liquids are presented. Both methods result in a descriptive measure called the Stokesian diameter of the particles which is based on the terminal velocity of particles in fluids as predicted by Stokes' law. One of the methods, gravity sedimentation using a recording balance, is useful in the nominal range of particle size of 5-100 microns. The second, photosedimentation, utilizes centrifugation to extend the range down to the area of 0.1 to 10 microns. Techniques of experimentation and methods of data reduction are discussed in detail for both methods. Complete computer programs for data analysis and sample outputs are included as appendices.
Author (GRA)

N72-18462# Philco-Ford Corp., Newport Beach, Calif.
APPLICATION OF PHOTOGRAPHIC EXTRACTION TECHNIQUES TO RADIOGRAPHIC NONDESTRUCTIVE TESTING Final Report
K.-H. Lohse and H. H. Avant 9 Nov. 1971 120 p refs
(Contract N00014-69-C-0120)
(AD-733224) Avail: NTIS CSCL 14/5

The objectives of the research were to define the merits and possible limitations of Aeronutronic's color derivation extraction process as applied to radiographs (CODE-R) and compare these data with conventional radiographic techniques. The results of the study show that Aeronutronic's technique has significant application in analysis of certain types of radiographs. Of particular note is the ability of CODE-R to illustrate flaws in parts that are typically difficult to inspect by conventional means.
GRA

N72-18463# Varian Associates, Palo Alto, Calif.
PHOTOEMISSIVE DETECTOR Final Technical Report
R. L. Bell Aug. 1971 28 p refs
(Contract N00014-71-C-0073; ARPA Order 306)
(AD-733083) Avail: NTIS CSCL 09/1

A program of fabrication of four image tubes using InAsp transmission photocathodes sensitive to 0.965 micron radiation is described. These tubes were intended for imaging parametric upconversion experiments. A number of anticipated difficulties were encountered, and the sensitivity of the tubes shipped was a factor of only ten higher than commercially available image tubes, rather than the factor of 100 believed to be available under the most favorable conditions. The background noise was high, indicating the need for further improvements in tube and process design. Author (GRA)

N72-18464# Technology, Inc., Dayton, Ohio.
INTRODUCTION TO MULTISENSOR RECONNAISSANCE Final Report, Jul. 1969 - Dec. 1970
James E. Hawkins and Horace H. Valverde Jun. 1971 114 p refs Prepared in cooperation with Autonetics, Anaheim, Calif.
(Contract F33615-69-C-1187; F33615-69-C-1821)
(AD-733347; AFAL-TR-71-43) Avail: NTIS CSCL 15/7

The document presents a comprehensive, but practical introduction to multisensor usage in aerial reconnaissance. It covers primarily the current and conceptual multisensors operating in electro-optical and microwave regions of the electro-magnetic spectrum, the various types of aerial reconnaissance/surveillance missions, and the factors to be considered in utilizing these sensors for such missions. The document also includes a bibliography and an extensive glossary to cover all reconnaissance-oriented nomenclature. Author (GRA)

N72-18465# Lockheed-California Co., Burbank.
THIN FILM MAGNETIC SENSOR Final Report on Phase 1
Frank J. Fuller 30 Sep. 1971 67 p refs
(Contract N00014-71-C-0298; NR Proj. 220-038/02-17-71)
(AD-733702; LR-24792) Avail: NTIS CSCL 17/6

The final report covers the work conducted under this first phase of the above contract for ONR. The objectives were two-fold: comparison tests of a thin film sensor and the present production aircraft magnetic anomaly detector (MAD) the AN/ASQ-81, and preliminary tests of the basic concept of three axis sum/square motion compensation. Comparison testing indicated a thin film sensor performance, as expected, below ASQ-81 performance of the order of one quarter the range. However, data presented indicates a range ratio probability of one-half or better. The results of the 3-axis motion compensation tests using arithmetical computation of the sum/square function produced a motion compensated output. Author (GRA)

N72-18466# Utah Univ., Salt Lake City. Microwave Device and Physical Electronic Lab.
SOLID STATE OPTICAL DETECTOR Quarterly Report, 1 Jan. - 31 Aug. 1971
Roland W. Ure, Jr. and Richard W. Grow 31 Aug. 1971 45 p refs
(Contract N00014-67-A-0325-0005)
(AD-733695; UTEC-MD-71-210; QR-1) Avail: NTIS CSCL 09/1

The purpose of this project is to design and fabricate photo detectors which have an active cross-sectional area of 1 sq. mm and which will demodulate two laser beams leaving a frequency difference from low frequencies up to 11 GHz. In this report, the design of the detector is discussed. The only types of solid state devices which can satisfy the requirements are either p-i-n diodes or Schottky barrier diodes fabricated on semiconductor chips on which a thin (5.5 to 9.0 micrometer depending on the material) epitaxial layer has been grown. Because of the high frequency involved, carrier transit times limit the thickness of the depletion region in the device. This, together with the area requirement, gives the device a capacitance between 12 and 23 pF which is large at 11 GHz. A sufficiently high cutoff frequency for the device can be obtained only if the series resistance is sufficiently low. Specific designs using silicon and GaAs are discussed, and the critical parts of the design identified. Author (GRA)

N72-18467# Long Island Univ., Greenvale, N.Y. Science Engineering Research Group.
MULTISPECTRAL PHOTOGRAPHIC REMOTE SENSING OF COASTAL ENVIRONMENTS Final Technical Report
Edward Yost, Robert Anderson, Rajender Kalia, Vincent Posteraro, and Sondra Wenderoth 31 Jul. 1971 353 p refs
(Contract N00014-68-A-0284-0001; NR Proj. 387-041)
(AD-733691; SERG-TR-11) Avail: NTIS HC $6.00/MF $0.95 CSCL 14/5

Experiments to determine the usefulness of multispectral photography for the remote sensing of coastal water environments were conducted in northeastern Massachusetts, Long Island, New York, and Barataria Bay, Louisiana. Multispectral imagery was associated with in situ spectra and water sample analysis simultaneously obtained. Changes in the amplitude and shape of both the downwelling irradiance spectra and upwelling radiance spectra were found to be associated with the amount and type of particulant in suspension. Author (GRA)

N72-18468# Naval Air Development Center, Johnsville, Pa. Aero Structures Dept.
STATISTICAL REVIEW OF COUNTING ACCELEROMETER DATA FOR NAVY AND MARINE FLEET AIRCRAFT FROM 1 JANUARY 1962 TO 1 JULY 1971 Summary Report
Thomas A. DeFiore 1 Nov. 1971 110 p ref
(AD-733678; NADC-ST-7108-1) Avail: NTIS CSCL 14/2

The report is a specialized summary of normal acceleration data recorded by counting accelerometers. Data are separated by calendar time and mission category. Only data reported in the counting accelerometer program are included. Author (GRA)

N72-18469# Southwest Research Inst., San Antonio, Tex.
A FACILITY AND INSTRUMENTATION FOR STUDYING ENGINE CONTROL AND PERFORMANCE Technical Report, 2 Dec. 1969 - 1 Jun. 1971
James E. Johnson, William J. Astleford, Jesse L. Holster, Robert L. Bass, III, and C. Richard Gerlach Wright-Patterson AFB, Ohio AFAPL Nov. 1971 111 p refs
(Contract F33615-69-C-1231; AF Proj. 3066)
(AD-733353; SWRI-RS-576; AFAPL-TR-71-80; TR-2) Avail: NTIS CSCL 14/2

The general objectives of the present study are threefold: (1) to implement an engine test facility incorporating a digital computer for data reduction and analysis, and for advanced control and performance studies, (2) to advance the state-of-the-art of instrumentation for measuring flow variables and other parameters in propulsion systems, and (3) to provide feasibility demonstrations of new parameter sensing techniques for control applications, of new control mechanizations, of advanced engine control loops, and of high response actuators. Initial studies of a single resonant tube fluidic temperature sensor have demonstrated its potential for turbine inlet temperature sensing. Author (GRA)

N72-18470# Aerospace Medical Research Labs., Wright-Patterson AFB, Ohio.
TANDEM THERMOGRAVIMETRIC ANALYZER - TIME-OF-FLIGHT MASS SPECTROMETER SYSTEM DESIGNED FOR TOXICOLOGICAL EVALUATION OF NONMETALLIC MATERIALS Final Report, Jan. 1970 - Aug. 1971
Gerd A. Kleineberg and David L. Geiger Oct. 1971 17 p refs
(AF Proj. 6302)
(AD-733709; AMRL-TR-71-71) Avail: NTIS CSCL 06/20

An automatic electrobalance has been coupled in series with a mass spectrometer. The balance is part of a thermogravimetric analysis (TGA) system which also consists of a furnace with temperature programming capability and a strip chart recorder. A heated stainless steel capillary tube leading from close proximity of the sample inside the TGA instrumentation to the ion source of the mass spectrometer functions as the interface of the two system components. The Time-of-Flight mass spectrometer with its inherent high speed scanning capability has been modified to include a variable output integrator. This combination enables the toxicologist to relate conventional thermogravimetric analysis information to the unequivocal identification of potentially toxic thermal decomposition products. Newly developed fire retardant materials for use in interiors of passenger and cargo aircraft are analyzed to provide information on which to evaluate their toxicity potential under conditions of normal use and catastrophic situations such as fire. Author (GRA)

N72-18471# Pennsylvania State Univ., University Park. Dept. of Aerospace Engineering.
AN ANALYSIS OF THE LASER DOPPLER VELOCIMETER

AND ITS APPLICATION TO THE MEASUREMENT OF TURBULENCE Ph.D. Thesis - Johns Hopkins Univ.
William K. George, Jr. Sep. 1971 161 p refs
(Contract N00014-67-A-0385-0013)
(AD-733493) Avail: NTIS CSCL 14/2

An operational Laser-Doppler Velocimeter is described and measurements of spectra in both laminar and turbulent flow are presented. Author (GRA)

N72-18472# Army Foreign Science and Technology Center, Charlottesville, Va.
TYPE GF-65 GONIOPHOTOMETER
G. N. Egerov and Yu. M. Grigorev Oct. 1971 11 p refs
Transl. into ENGLISH from Svetotekhn. (USSR), no. 8, Aug. 1969 p 14-16
(FSTC Proj. T7023012301)
(AD-733767; FSTC-HT-23-604-71) Avail: NTIS CSCL 20/6

For studying lighting engineering and other materials and parts, a small series of universal photoelectric goniophotometers (Type GF65) was devised at the All Union Scientific Research Institute of Illuminating Engineering in 1965. The instrument is described and its operation is discussed. GRA

N72-18473# Arnold Engineering Development Center, Arnold Air Force Station, Tenn.
LASER INSTRUMENTATION IN AEDC TEST FACILITIES Final Report
David G. Francis Dec. 1971 40 p refs
(AD-733740; AEDC-TR-71-227) Avail: NTIS CSCL 14/2

Various laser systems being used for tests in laboratories and environmental facilities at AEDC are described. These systems include the laser Doppler velocimeter used for flow field diagnostics, laser holography used for flow field visualization and particle studies, laser spark generation used to measure velocities in high speed flows, laser photography used for visualization during ablation tests, and vapor screen systems used to visualize flow patterns around models. Schematics of the systems are given, and some results from tests which have utilized laser instrumentation are presented. GRA

N72-18474# Development and Resources Transportation Co., Silver Spring, Md.
THE PREDICTION OF CIVIL ENGINEERING PROBLEMS IN THE ARCTIC BY MEANS OF DUAL-CHANNEL 1-R SCANNING AND AEROCHROME INFRARED PHOTOGRAPHY Semiannual Technical Report, 15 Apr. - 31 Oct. 1971
Leonard A. LeSchack, Frederick H. Morse, Wm. R. Brinley, Jr., Nancy G. Ryan, and Robert B. Ryan Nov. 1971 110 p refs
(Contract N00014-71-C-0396; ARPA Order 1772; NR Proj. 307-339)
(AD-733751; D/RT-7; SATR-1) Avail: NTIS CSCL 14/5

The feasibility of detecting massive ice in permafrost by sensing the associated surface thermal anomalies with an airborne synchronous dual-channel infrared (I-R) line scanner is discussed in this first semi-annual report. Three broad areas of research are involved: (a) the determination and qualification by both mathematical modeling and ground truth field studies of significant parameters useful in detecting any thermal anomalies caused by near surface ice in permafrost, (b) the modification of a standard quantitative I-R scanner to synchronously sense and record radiation emitted in the 4.5-5.5 and 8-12 micron bands, and (c) the processing electronically of the recorded information to obtain the ratio and product imagery used to delineate the thermal anomalies sought. Author (GRA)

N72-18475# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
PROTON ACTIVATED RECESSION SENSOR (PARS), VOLUME 1 Final Report
A. J. Armini and L. M. Langsam Sep. 1971 217 p refs
(Contract F04701-68-C-0288)
(AD-733781; SAMSO-TR-71-197) Avail: NTIS CSCL 16/3

A program was conducted to study the feasibility of using proton activation techniques to provide an in situ line source of radioactivity in ATJ-S graphite for application to the measurement of rate of recession on a graphite nosetip during reentry. The Be-7 produced by high energy protons ($E > 28$ MeV) in a graphite target emits monoenergetic gamma radiation ($E = 0.48$ MeV). These gamma rays are detected and counted as a function of reentry time to monitor recession of the nosetip. Author (GRA)

N72-18476# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
AN INSTRUMENT FOR DETERMINING THE LAW OF FRICTION AND WEAR
G. Anguelov, O. Kuchukov, and G. Stamatov 13 Oct. 1971 16 p refs Transl. into ENGLISH from Mashinostoenie (USSR), v. 19, no. 8, 1970 p 329-331
(AF Proj. 7343)
(AD-734060; FTD-HC-23-823-71) Avail: NTIS CSCL 14/2

A new type of device is described for determining the principle of friction and wear of friction pairs. Explanation is given about the manner of operating with it. The article shows the precision of operation of the device and its advantages compared with familiar devices used previously. GRA

N72-18252# Academy of Sciences (USSR), Moscow.
THE LUNAR AUTOMATIC SPECTROMETER RIFMA
G. Ye. Kocharov, N. F. Borodulin, S. V. Viktorov, O. M. Voropayev, A. Yu. Dzevanovskaya, O. G. Ivanov, G. V. Kiryan, V. V. Petrov, and V. A. Sakulskiy *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 89-95 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

N72-18339*# California Univ., Berkeley.
MULTISTAGE SAMPLING OF EARTH RESOURCES WITH AERIAL AND SPACE PHOTOGRAPHY
Philip G. Langley *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 129-141 refs (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 14E

N72-18340*# California Univ., Berkeley.
THE USE OF SMALL-SCALE AERIAL PHOTOGRAPHY IN A REGIONAL AGRICULTURAL SURVEY
William C. Draeger and A. S. Benson *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 143-149 refs (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 14E

15 MACHINE ELEMENTS AND PROCESSES

Includes bearings, seals, pumps, and other mechanical equipment; lubrication; friction, and wear; manufacturing processes and quality control, and reliability; drafting; and materials fabrication, handling, and inspection.

N72-18477* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MINIMECH SELF-DEPLOYING BOOM MECHANISM Patent
William T. Tumulty, Jr. and Wayne P. Sours, inventors (to NASA) Issued 28 Sep. 1971 8 p Filed 31 Dec. 1969 Supersedes N70-22272 (08-09, p 1642)
(NASA-Case-GSC-10566-1; US-Patent-3,608,844; US-Patent-Appl-SN-889438; US-Patent-Class-242-54; US-Patent-Class-52-108) Avail: US Patent Office CSCL 13C

An extendable, self-deploying boom apparatus is described, in which the boom is of any present type fabricated from thin metal strip which has a tendency to unwrap when wound around upon a cylindrical storage spool. The end portion of the boom is restrained between the storage spool and a cooperating roller serving to hold the boom in place upon the storage spool. Resilient springs compress the cylindrical surfaces of the spool and roller together along a mutual line of pressure, thus producing a force in a portion of the boom between rollers and which acts parallel to the boom's major axis. Such a force is derived from the storage energy of the boom and permits self-deployment of the boom when the spool and roller are unrestrained for counterrotating motion. The springs maintain a mutual line of pressure between the rollers as additional portions of the boom progressively unwind.
Official Gazette of the U.S. Patent Office

N72-18478# Central Electricity Generating Board, London (England).
RELIABILITY PROGRAMMING: A SELECTIVE BIBLIOGRAPHY, 1960 OCTOBER 1971
P. G. Williams, comp. Dec. 1971 12 p refs
(CE-Bib-2) Avail: NTIS

A selective bibliography on reliability programming is presented. The collection contains 47 references and covers various aspects of reliability management systems. G.G.

N72-18479*# Aerojet Liquid Rocket Co., Sacramento, Calif.
BIPROPELLANT SHUT-OFF VALVE Final Report
J. V. Smith 17 Dec. 1971 75 p refs
(Contract NAS7-733)
(NASA-CR-125611; Rept-7-733-2F) Avail: NTIS CSCL 13K

An advanced design of an all metal, fast response, bipropellant, shut-off valve for use on long duration space missions is reported. The valve provides the flow control capability for a 1,000 lb thrust, bipropellant engine using oxygen difluoride and diborane as propellants. The shutoff seal selection is a soft-on-hard metal concept. The soft seal is a spherical shell that seats against a hard conical seat. Beryllium copper and beryllium nickel seals were selected to seal against an electrolyzed Inconel 718 seat. Poppet shaft sealing is achieved by use of hydroformed, Inconel 718 bellows. Two valve assemblies were fabricated and subjected to a series of tests including leak, response time, flow capacity, dry cycles, water cycles, liquid nitrogen cycles, liquid fluorine cycles, and lead-lag operation cycles. These tests demonstrated the ability of the valve to meet design goals. Author

N72-18480# Joint Publications Research Service, Washington, D.C.
SELECTION OF RESPONSIVE BALLBEARING DESIGN IN A GYROSCOPE ASSEMBLY
V. A. Matveyev and N. P. Maslov 9 Feb. 1972 6 p refs
Transl. into ENGLISH from Priborostroenie (USSR), no. 4, 1971 p 79-82
(JPRS-55144) Avail: NTIS

The possibility is examined of an additional moment of sliding friction forces in bearings with a sphere-pivot element which receives the axial load. Recommended schemes of pillow bearings are presented which can be used with a minimal additional moment of sliding friction forces. Author

N72-18481*# National Aeronautics and Space Administration, Washington, D.C.
METALLURGICAL STUDY OF BRAZED ASSEMBLIES FOR THE PURPOSE OF PRODUCING VACUUM TIGHTNESS AT 500 C
P. Dumon Feb. 1972 30 p refs Transl. into ENGLISH from Soudage Tech. Connexes (Paris), v. 17, 1963 p 426-438
(NASA-TT-F-14112) Avail: NTIS CSCL 13H

Brazed joints of vacuum tubes must be manufactured efficiently with assured escape flow of less than 10 to the minus 8th power (cu cm) (torr/sec/sec) during a thermal cycle of 500 C. Various joints are examined in the light of factors influencing joint compactness, such as function of clearance and length to be brazed. Effects of the presence of shrinkage cavities and blisters combined with superheating are studied along with the brazing of joints composed of metals with differing expansions. Author

N72-18482# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
MECHANICS OF PNEUMATIC TIRES
Samuel K. Clark, ed. Washington NBS Nov. 1971 853 p refs
(Contract NBS-386; Proj. 4080401; NBS-FH-11-6090)
(NBS-Monograph-122; NBS-MN-122; LC-70-611535) Avail: SOD $4.75 as C13.44:122

A description of the characteristics and applications of pneumatic rubber tires is presented. Subjects discussed are: (1) characteristics of materials, (2) tire cord structure and properties, (3) bonding of tire cords and rubber, (4) properties of cord-rubber laminates, (5) structure of tires, (6) tire stress and deformation, (7) skid resistance and directional control, and (8) the tire as a vehicle component. For individual titles, see N72-18483 through N72-18492.

N72-18483# Michigan Univ., Ann Arbor.
RUBBER STRUCTURE AND PROPERTIES c18
S. D. Gehman *In its* Mech. of Pneumatic Tires Nov. 1971 p 1-40 refs (See N72-18482 09-15)
Avail: Sod $4.75 as C13.44:122

The physical and mechanical properties of materials used in the construction of pneumatic rubber tires are presented. The ingredients in tire compounds are identified and classified. Laboratory tests to evaluate the properties of rubber compounds for technical purposes are described. Thermodynamic and elastic properties of rubber for pneumatic tires are described. The importance of viscoelasticity in tire compounds is stressed. Author

N72-18484# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
FRICTION OF RUBBER c18
K. C. Ludema *In its* Mech. of Pneumatic Tires Nov. 1971 p 41-62 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

The fundamentals of friction and their application to the performance of pneumatic rubber tires are discussed. The subjects presented are: (1) phenomenological laws of friction, (2) mechanical classes of tire and rubber friction, (3) combined components of friction, and (4) longitudinal and lateral tire slip and slide. Data are presented as mathematical models and graphs. Author

N72-18485# Massachusetts Inst. of Tech., Cambridge. Dept. of Mechanical Engineering.
TIRE CORD STRUCTURE AND PROPERTIES
Stanley Backer *In* Mich. Univ. Mech. of Pneumatic Tires Nov. 1971 p 63-217 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

The characteristics, structure, and mechanical properties of cords used in the manufacture of pneumatic rubber tires are discussed. The uniqueness of tire reinforcement design is discussed. The structural geometry of textile tire cords and the interaction of the geometry with the mechanical properties of the component filaments to influence cord behavior are analyzed. The mechanical and physical properties of tire cords are expressed in mathematical models and charts. Author

N72-18486# Toray Industries, Inc., Otsu (Japan). Fibers and Textile Research Labs.
RECENT DEVELOPMENTS WITH TIRE CORDS AND

CORD-TO-RUBBER BONDING

T. Takeyama and J. Matsui *In* Mich. Univ. Mech. of Penumatic Tires Nov. 1971 p 219-305 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

Recent developments with tire cords and cord to rubber bonding in the manufacture of pneumatic rubber tires are discussed. Subjects presented are: (1) physical properties of tire cords, (2) rubber to cord bonding, (3) effects of twist on cord properties, (4) fatigue resistance of tire cords, (5) adhesive treatment of nylon and rayon, and (6) evaluation of adhesives. Data are presented in tables and charts for various cords, textiles, and adhesives. Author

N72-18487# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.

PROPERTIES OF CORD-RUBBER LAMINATES c18

Samuel K. Clark *In its* Mech. of Pneumatic Tires Nov. 1971 p 307-353 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

The increased use of more sophisticated structural configurations in pneumatic tires during the last few years has resulted in a greater interest in the elastic properties of cord-rubber laminates. Much of the reason for this may be found by considering the basic nature of redundant structures, in which the loads carried by individual cords are in part determined by the elastic characteristics of the entire system. In such situations, a knowledge of elastic characteristics becomes important to good structural design practice. A knowledge of elastic characteristics is important in obtaining optimum reinforcement properties, and such studies inevitably lead to a clearer understanding of the internal stress states of all reinforced materials. One result of this research is that much of the work done in the areas of fiberglass and whisker reinforcement has increased the general understanding, in a broad way, of the action of cord reinforced rubber. The main aspects of the problems are similar. Although major differences exist in the structure of the reinforcement itself and in the fact that in many reinforced elastomers the cords are anchored to some relatively rigid structural member. Author

N72-18488# Michigan Univ., Ann Arbor.

STRUCTURE OF THE TIRE

V. E. Gough *In its* Mech. of Pneumatic Tires Nov. 1971 p 355-404 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

The structural requirements for pneumatic rubber tires under normal operating conditions are discussed. The basic structural requirements presented are: (1) no appreciable change of size upon inflation, (2) an ability to envelope obstacles without sustaining damage, (3) the ability to deform from a surface of double curvature to a plane surface, and (4) enough rigidity to develop substantial forces in any direction. Various designs of tires and methods of tire construction are presented to show how these requirements are met. An analysis of the results obtained by various manufacturing methods is included. Author

N72-18489# Firestone Tire and Rubber Co., Akron, Ohio. Central Res. Labs.

TIRE STRESS AND DEFORMATION c32

Joseph D. Walter *In* Mich Univ. Mech. of Pneumatic Tires Nov. 1971 p 405-444 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

Analytical techniques for determining tire stress and deformation are discussed. Subjects presented are: (1) solutions for inflation loads, (2) cord to rubber interface shear stress, (3) solutions for centrifugal loads, and (4) methods for analyzing the tire in service. Data are presented in the form of mathematical models and charts. Author

N72-18490# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.

THE CONTACT BETWEEN TIRE AND ROADWAY c32

Samuel K. Clark *In its* Mech. of Pneumatic Tires Nov. 1971 p 445-499 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

The experimental data and the appropriate mathematical models for three characteristics of a rolling elastic tire are examined. The primary characteristics are: (1) the area of contact between the tire and the road, (2) the slip or relative motion between the tire and the road, and (3) normal and tangential contact stresses between the tire and the road. The effects of inflation pressure, rolling velocity, path of rolling relative to midplane, and the amount of the load on the characteristics of the tire are described. Author

N72-18491# Natural Rubber Producers Research Association, Welwyn Garden City (England).

SKID RESISTANCE AND DIRECTIONAL CONTROL c32

A. Schallamach *In* Mich. Univ. Mech. of Pneumatic Tires Nov. 1971 p 501-544 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

The control of speed and direction of a self-propelled vehicle by the forces between the tires and the road is discussed. Relevant facts on the connection between the forces applied to a wheel and change in its velocity are reviewed. Equations are derived which allow a semiquantitative assessment of the functional relations. Mathematical models and charts are used to analyzed the various forces imposed upon the wheel and tires under several conditions. Author

N72-18492# Technische Hogeschool, Delft (Netherlands).

THE TIRE AS A VEHICLE COMPONENT

H. C. A. VanEldikthieme and H. B. Pacejka *In* Mich. Univ. Mech. of Pneumatic Tires Nov. 1971 p 545-839 (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

An analysis of the parameters affecting the operation of pneumatic rubber tires and methods for conducting tests to establish the forces imposed on a tire are described. Subjects discussed are: (1) straight line rolling experiments, (2) load-deflection relationships, (3) effective rolling radius, (4) rolling resistance, (5) braking and traction, (6) cornering and cambering experiments, and (7) nonsteady-state motions. The test equipment involved in measureing the forces and the results of various tests are included. Author

N72-18493*# General Electric Co., Cincinnati, Ohio.

FABRICATION AND TEST OF A SPACE POWER BOILER FEED ELECTROMAGNETIC PUMP. 3: ENDURANCE AND FINAL PERFORMANCE TESTS

A. H. Powell and J. C. Amos Washington NASA Mar. 1972 94 p refs
(Contract NAS3-9422)
(NASA-CR-1951; GESP-459) Avail: NTIS CSCL 13K

A three-phase helical induction electromagnetic pump designed for the boiler feed pump of a potassium Rankine cycle space power system was developed and built. It was mounted in a liquid metal test loop and successfully tested over a range of potassium temperatures from 900 to 1400 F, flow rates from 0.75 to 4.85 lb/sec, developed pressures up to 340 psi, net positive suction head from 1 to 22 psi, and NaK coolant temperatures from 800 to 950 F. Maximum efficiency at design point conditions of 3.25 lb/sec flow rate, 240 psi developed head, 1000 F potassium inlet temperature, and 800 F NaK coolant inlet temperature was 16.3 percent. After the performance tests the pump was operated without any difficulty at design point for 10,000 hours, and then a limited number of repeat performance tests were made. There was no appreciable change in pump performance after 10,000 hours of operation. A supplementary series of tests using the quasi-square wave power output of a dc to three-phase ac inverter showed that the pump would operate without difficulty at a frequency as low as 25 Hz, with little loss in efficiency. Author

N72-18494*# Hauser Research and Engineering Co., Boulder, Colo.
LEAK DETECTION WITH EXPANDABLE COATINGS Final Report, 19 Feb. - 18 Dec. 1971
18 Dec. 1971 61 p
(Contract NAS8-26761)
(NASA-CR-123532; DCN-1-1-60-0010; Rept-5300-71-20)
Avail: NTIS CSCL 13L

Developed and evaluated is a system for leak detection that can be easily applied over separable connectors and that expands into a bubble or balloon if a leak is present. This objective is accomplished by using thin films of Parafilm tape wrapped over connectors, which are then overcoated with a special formulation. The low yield strength and the high elongation of the envelope permit bubble formation if leakage occurs. This system is appropriate for welds and other hardware besides separable connectors. The practical limit of this system appears to be for leaks exceeding 0.000001 cc/sec. If this envelope is used to trap gases for mass spectrometer inspection, leaks in the range of ten to the minus 8th power cc/sec. may be detectable. Author

N72-18495*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EXPERIMENTS ON THE STABILITY OF VARIOUS WATER-LUBRICATED FIXED GEOMETRY HYDRODYNAMIC JOURNAL BEARINGS AT ZERO LOAD
Fredrick T. Schuller 1972 30 p refs Proposed for presentation at Lubrication Conf., New York 9-12 Oct. 1972, sponsored by ASME and Am. Soc. of Lubrication, Eng.
(NASA-TM-X-68014; E-6710) Avail: NTIS CSCL 13I

Hydrodynamic journal bearing stability tests were conducted with 1.5 in. diameter, 1.5 in. long fixed geometry bearings in water at 80 F with zero load. Five fixed geometry bearings were rated in order of diminishing stability as follows: (1). three-tilted-lobe bearing (offset factor of 1.0), (2) herringbone-groove bearing, (3) one-segment, three-pod, shrouded Rayleigh-step bearing, (4) three-tilted-lobe journal with axial grooves (offset factor of 1.0) mated with a plain bearing, and (5) three-centrally-lobed bearing with axial grooves (offset factor of 0.5). The various parameters that affect the stability of each bearing configuration were investigated. Author

N72-18496*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GRAPHITE FLUORIDE AS A SOLID LUBRICANT IN A POLYIMIDE BINDER
Robert L. Fusaro and Harold E. Sliney Washington Mar. 1972 16 p refs
(NASA-TN-D-6714; E-6694) Avail: NTIS CSCL 11H

Polyimide resin (PI) was shown to be a suitable binder material for the solid lubricant graphite fluoride, (CF(1.1))n. Comparisons were made to similar tests using PI-bonded MOS2 films, graphite fluoride rubbed films, and MOS2 rubbed films. The results showed that, at any one specific temperature between 25 and 400 C, the wear life of PI-bonded graphite fluoride films exceeded those of the other three films by at least a factor of 2 and by as much as a factor of 60. Minimum friction coefficients for the PI-bonded films were 0.08 for graphite fluoride and 0.04 for MOS2. The rider wear rates for the two PI-bonded films at 25 C were nearly equal. Author

N72-18497# Joint Publications Research Service, Arlington, Va.
COMPARATIVE EVALUATION OF VARIOUS METHODS OF REFINING TITANIUM TETRACHLORIDE
L. A. Niselson, Yu. V. Golubkov, and T. Ye. Khudaybergenov 24 Feb. 1972 14 p refs Transl. into ENGLISH from Tsvetn. Metal. (Moscow), no. 11, 1971 p 41-46
(JPRS-55263) Avail: NTIS

The basic purification methods for titanium tetrachloride are reviewed, especially those for the removal of vanadium. Of the various chemical and physicochemical methods considered, an adsorption methods in the liquid phase of TiCl4 with removal of VOCl3 and the treatment with transformer oil are the best purification methods. Author

N72-18498# Joint Publications Research Service, Arlington, Va.
MODELS AND METHODS USED IN CREATING AUTOMATED SYSTEMS OF CONTROL
V. V. Kulba, A. G. Mamikonov, and A. D. Tsvirkun 18 Feb. 1972 27 p refs Transl. into ENGLISH from Avtomatika i Telemekhanika (Moscow), no. 7, 1971 p 116-132
(JPRS-55227) Avail: NTIS

A list of basic problems arising during the process of designing an ASU (automated system of control) for a certain sector is presented. The mathematical models and methods used in different stages of designing the ASU are reviewed. Formulations are given for a number of problems which are encountered in developing a sectorial ASU and in creating its informational software. Author

N72-18499*# Scientific Translation Service, Santa Barbara, Calif.
BULK VAPOR-FORMATION PROCESSES DURING THE ACTION OF A LASER BEAM ON METALS
N. N. Rykalin and A. A. Uglov Washington NASA Mar. 1972 16 p refs Transl. into ENGLISH from Teplofiz. Vys. Temp. (USSR), v. 9, May - Jun. 1971 p 575-582
(Contract NASw-2035)
(NASA-TT-F-14144) Avail: NTIS CSCL 20E

Problems in the physics of bulk vaporization within surface layers of metal melts heated by laser radiation are analyzed. It is shown that bulk vapor formation on artificial centers (gas bubbles, inclusions, and dispersed solid particles) leads to supplementary transfer of mass from the beam's zone of action on the metal. The influence of this process on mass transfer from the zone of action is also examined for other sources such as electron beams and a pulsed spark discharge. Author

N72-18500# National Research Council of Canada, Ottawa (Ontario). Div. of Mechanical Engineering.
EVALUATION OF FIRE RESISTANT LUBRICANTS FOR INDUSTRIAL GAS TURBINES
L. Gardner and G. Moon Nov. 1971 15 p refs
(MP-56; NRC-12433) Avail: NTIS

The use of fire resistant lubricants, of the phosphate ester type, in industrial gas turbines used for natural gas transmission is widely accepted. These fluids are more expensive than petroleum lubricants and a long service life is required to make their use economically viable. Preliminary laboratory screening of new candidate fluids for their ability to resist oxidative and thermal breakdown is a useful measure prior to field evaluation. Little previous work has been done to develop methods for measuring thermal and oxidative stability of phosphate esters and the present report describes the adaptation of two test procedures normally used for aircraft synthetic lubricants for this purpose. Test parameters were established using a long established proprietary phosphate ester fluid and then using the same conditions, some fourteen candidate fluids were evaluated. Author

N72-18501# Royal Aircraft Establishment, Farnborough (England).
INSTRUCTION CONCERNING CASTINGS FOR AERONAUTICAL USE, EDITION 3, 30 NOVEMBER 1956
Feb. 1971 62 p Transl. into ENGLISH from Ministere de la Defense Nationale, report AIR-3380
(RAE-Lib-Trans-1557; AIR-3380; BR-27949) Avail: NTIS

This new edition of Specification AIR 3380 contains the following modifications: Introduction of inspection procedures for motor and turbo-machinery components; new magnesium alloys having mechanical properties superior to those of the alloys used hitherto; optional omission of cut-up tests and radiographic inspection for pressure-tight components; relaxation of radiographic inspection of Class B components; and the granting of permission to combine break-up and cut-up tests. Author

N72-18502*# Lockheed Missiles and Space Co., Sunnyvale, Calif.
PARTS, MATERIALS, AND PROCESSES EXPERIENCE SUMMARY
24 Feb. 1972 381 p refs
(Contract NAS2-6060)
(NASA-CR-114391) Avail: NTIS HC $6.00/MF $0.95 CSCL 13H

The objective of this summary is to provide users with the accumulated experience resulting from the ALERT reports issued by NASA and the Government-Industry Data Exchange Program (GIDEP). Related industry experience has also been included to provide the user with information available to the contractor at the time of preparation. The ALERT program has as its basic objective the avoidance, or at least the minimization, of the recurrences of parts, materials, and processes problems; thus improving the reliability of equipment produced for and used by the Government. Major topics (attaching methods, capacitors, transistors, etc.) cover 82 percent of the reports. Therefore, expanded information upon these topics is provided by relating the problem area (failure) to the cause, the investigation and findings, the suggestions for avoidance (inspections, screening tests, proper part applications, requirements for manufacturer's plant facilities, etc.), and failure analysis procedures. The remaining ALERT reports are included through the medium of ALERT summaries. Author

N72-18503# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
AN EVALUATION OF THE RECIRCULATING CHROMATE RINSE CONCEPT FOR AIRCRAFT CORROSION CONTROL
W. C. Hallow and W. E. Knight 16 Sep. 1971 24 p refs
(NAEC Proj. PO-1-8027)
(AD-732762; NADC-MA-7160) Avail: NTIS CSCL 01/3

A feasibility study of the recirculating chromate aircraft rinse is presented. A preliminary design plan is presented, along with test data to support the design conclusions. Author (GRA)

N72-18504# Honeywell, Inc., Minneapolis, Minn.
DESIGN AND ANALYSIS OF A SELF-GENERATED HYDROSTATIC SUPPORT FOR AN AIR BEARING GYRO, SUPPLEMENT Final Report
L. H. Rood 29 Oct. 1971 18 p refs
(Contract DAAH01-70-C-1390)
(AD-733439; Rept-21605-SR) Avail: NTIS CSCL 17/7

The device is a cam-driven, positive-displacement piston pump with positive-acting valves, implemented integrally within a gyro spinmotor. Author (GRA)

N72-18505# Battelle Memorial Inst., Columbus, Ohio.
SLEEVE BEARING MATERIALS AND LUBRICANTS FOR ADVANCED AIRFRAMES
Keith F. Dufrane, William A. Glaeser, and Fred F. Zugaro 19 Nov. 1971 38 p
(Contract N00019-71-C-0119)
(AD-733705) Avail: NTIS CSCL 01/3

Bearing materials, shaft materials, and lubricants for airframe-bearing applications have been evaluated using an apparatus that simulates the loads, motions, and temperatures encountered by typical airframe bearings. Beryllium-copper bearings, which are capable of operation at very high stresses in reversing-load applications, were found to be limited to 20,000 psi for satisfactory operation in unidirectional loading. On the other hand, aluminum-bronze bearings were capable of operation at higher unidirectional loads than they were under reversing loads. Beryllium-copper bearings were also found to be sensitive to lubricant starvation; regular relubrication is required to insure satisfactory operation. Elevated-temperature bearing experiments using several versions of MIL-G-81322 grease showed a considerable variation in performance. While some versions operated successfully at 350 F (which is the maximum recommended temperature), others were limited to 300 F. MIL-G-81322 and MIL-G-27617 provided adequate corrosion protection for unplated steel shafts in all but severe corrosion situations. Plasma-sprayed aluminum-bronze and 440 C stainless steel were shown to be promising airframe-bearing and shaft materials. Author (GRA)

N72-18506# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF NONSTATIONARITY ON THE BEARING CAPACITY OF A SECTOR GAS BEARING
B. S. Grigoryev 24 Aug. 1971 14 p refs Transl. into ENGLISH from Aerotermodinamika (USSR), no. 313, 1970 p 117-122
(AF Proj. 7343)
(AD-733215; FTD-MT-24-781-71) Avail: NTIS CSCL 13/9

Consideration of a plane problem for a cylindrical self supported gas bearing is given. One of the sliding surfaces (on the pin or the bearing) is divided by axial grooves into a number of sectors. A solution is obtained in the form of a series in small powers of the relative eccentricity. If the grooves are cut on a stationary surface of the bearing, the resulting bearing capacity is found to be greater than in the case where the grooves are located on the rotating pin. With an increase in the Harrison number this difference tends to zero. Author (GRA)

N72-18507# Naval Postgraduate School, Monterey, Calif.
PROGRAM FOR THE DESIGN OF AN AXIAL COMPRESSOR STAGE BASED ON THE RADIAL EQUILIBRIUM EQUATIONS
Kyriacos D. Papailiou 1971 64 p refs
(AD-733437; NPS-579PY719091A) Avail: NTIS CSCL 13/7

A computer program is presented to determine the three-dimensional flow conditions in an axial flow compressor stage. Entropy and energy gradients are taken into account as well as the radial shift and the curvatures of the axisymmetric stream surfaces. The program can be used at elevated Mach numbers since shock losses and compressibility effects are included. It represents an extension of work done for a research program to investigate the tip clearance effects in a three-stage compressor. GRA

N72-18508# Mechanical Technology, Inc., Latham, N.Y.
A NOVEL HYBRIDE TILTING-PAD BEARING
Anthony J. Smalley and Coda H. T. Pan 25 Oct. 1971 48 p refs
(Contract N00014-70-C-0135)
(AD-733494; MTI-71TR29) Avail: NTIS CSCL 13/9

A new journal bearing concept for gas and vapor lubrication is studied. This concept employs the stable tilting pad bearing operated under hybrid (combined hydrostatic and hydrodynamic) conditions. An analytical approach is developed which incorporates a number of the fluid flow features to be expected of such a bearing operating at high speed and fed by high pressure steam. Results based on this analysis are used to establish an effective configuration for the bearing. The stability characteristics of this configuration are computed, and the overall performance is compared with a plain self-acting tilting-pad bearing of the same size. Author (GRA)

N72-18509# Army Command and General Staff Coll., Fort Leavenworth, Kansas.
A PROPOSED MATHEMATICAL MODEL FOR PREDICTING MILITARY ELECTRONIC EQUIPMENT COMPONENT FAILURE RATES AND ISOLATING UNDERLYING FAILURE CAUSES M.S. Thesis
Raymond E. Starsman 1970 157 p refs
(AD-733389) Avail: NTIS CSCL 14/4

A mathematical expression for combining the entire failure rate curve is derived based on the assumption that the failure population is composed of three subpopulations, early, chance, and wearout. A graphical method is provided for separating the subpopulations and determining the parameters of the model. The expression is then applied to observed failure data in three detailed examples and in each case the model is shown to represent the observed data at the .05 significance level using the Kolmogorov-Smirnov Test. Two BASIC language computer programs are provided to simplify the use of the proposed model. Author (GRA)

N72-18510# North American Rockwell Corp., Seal Beach, Calif. Space Div.

A METHOD FOR EVALUATION AND SELECTION OF DEEP OCEAN LOAD HANDLING SYSTEMS. VOLUME 2: USERS MANUAL Final Report, 1 Jul. 1970 - 12 Feb. 1971

Port Hueneme, Calif. NCEL May 1971 523 p refs
(Contract N62399-70-C-0024)
(AD-730037; SD-71-293-2-Vol-2; NCEL-CR-71.010-Vol-2) Avail: NTIS HC $6.00/MF $0/95 CSCL 09/2

The study for the Development of a Method for the Evaluation and Selection of Deep Ocean Load Handling Systems was conducted to assist the U.S. Navy in performing seafloor construction projects through consideration of operations involving equipment and transport of materials for load implantment. The study has accomplished four primary tasks: (1) the assemblage and organization of data; (2) the development of a mathematical model which is descriptive of a generalized total deep ocean implantment mission; (3) translation of the data and model into a computerized method to enhance utilization; and (4) validation of the method through application of selected case examples. The method provides the capability to evaluate any selected deep ocean load handling system on the basis of critical mission parameters. Author

N72-18511# Naval Civil Engineering Lab., Port Hueneme, Calif.

EVALUATION OF PNEUMATICALLY SEALED DOORS FOR USE IN RFI SHIELDED ENCLOSURES Final Report, Jul. 1969 - Jan. 1971

H. A. Lasitter Oct. 1971 18 p
(AD-733657; NCEL-TN-1175) Avail: NTIS CSCL 13/1

A standard swinging door with fingerstock and pressure bladder recessed into the door periphery has been designed and developed at Naval Civil Engineering Laboratory. This door may be used as a kit and can be installed at any communications center where the shielding effectiveness is degraded by the door. Shielded enclosures at three military installations were visited and examined for operational performance. Each of the enclosures had at least one pneumatically sealed door installed as part of the shielded enclosure. Each enclosure exhibited a shielding effectiveness value of greater than 100 db; in one case, the values were greater than 120 db for frequencies greater than 200 kHz. The shielding effectiveness of the NCEL door was greater than 110 db at MIL-STD-285 test frequencies. Author (GRA)

N72-18512# Boeing Co., Seattle, Wash. Aerospace Group.

DIFFUSION WELDING OF WROUGHT BERYLLIUM Final Technical Report, 1 Dec. 1970 - 31 May 1971

Thomas J. Bosworth Wright-Patterson AFB, Ohio AFML Aug. 1971 58 p refs
(Contract F33615-71-C-1161; AF Proj. 7351)
(AD-733665; D180-10084-2; AFML-TR-71-56) Avail: NTIS CSCL 13/8

The objective of the study was to investigate the role of the microalloying elements on the diffusion welding of beryllium and to relate the welding behavior to variations in beryllium oxide content. Diffusion welding of beryllium was shown to involve the precipitation of intermetallic compounds of the joint interface. The rate of precipitation was temperature related, but was also related by the BeO, iron and aluminum contents singularly or collectively. It was also demonstrated that the strength and ductility of beryllium sheet containing 0.97% BeO can be altered by the diffusion welding temperature, quench rate and additional post weld thermal cycles. It was concluded that compounds formed between the beryllium and the microalloying elements play a significant role in the diffusion welding process and in the strength and ductility of wrought beryllium. Author (GRA)

N72-18513# Army Foreign Science and Technology Center, Charlottesville, Va.

LUBRICATION AT HIGH CONTACT PRESSURES

R. M. Matveevskii 7 Oct. 1971 18 p refs Transl. into ENGLISH from Mashinovedenie (ASSR), no. 5, 1969 p 86-93
(AD-733771; FSTC-HT-23-1326-71) Avail: NTIS CSCL 11/8

The work presents a review of reports read at the conference on lubrication and wear organized by the Institute of Mechanical Engineers in September 1967. Most of the reports covered in the survey are from British and American Sources. Author (GRA)

N72-18514# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

STUDY OF THE CARRYING CAPACITY GUIDES WITH HYDROSTATIC LUBRICATION

Mireea Romanita 28 Jul. 1971 13 p refs Transl. into ENGLISH from Constr. Masini (Bucharest), v. 21, no. 12, 1969 p 746-748
(AF Proj. 7343)
(AD-733791; FTD-HC-23-387-71) Avail: NTIS CSCL 13/9

The high precision operation of machines and instruments at a very fast or very slow rate presents special lubrication problems because of the difficulty involved in maintaining a film of the lubricating agent between adjoining surfaces both during motion and standstill of the system. Hydrostating lubrication was found useful to assure operation of guides, providing continued liquid friction at all velocities and loads imposed on the machine. Theoretical and design problems of these lubrication systems with practically zero wear are presented. The maximum and minimum applied load and film thickness were determined without taking the geometry of the adjacent surfaces into account; therefore experimental correction factors can be introduced in the theoretically derived formulas. Author (GRA)

N72-18515# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

THE PROBLEM OF ELECTRICAL PHENOMENA DURING FRICTION AND THE CUTTING OF METALS

S. N. Postnikov 17 Aug. 1971 23 p refs Transl. into ENGLISH from the book "Elektricheskie Yavleniya pri Trenii i Rezanii Metallov" 1969 p 35-48
(Contract F33657-71-D-0057; AF Proj. 7343)
(AD-733795; FTD-HC-23-737-71) Avail: NTIS CSCL 13/8

An analysis of equivalent electric currents corresponding to different operating conditions of friction pairs is made. The influence of thermoelectric effects on friction (cutting) of metals is examined. The value of the thermo EMF induced for stressed sliding regimes, and still more so, resistance of contact varies within very wide limits. A strong thermoelectric current passing along an interface acts as a stimulus to adhesion, seizure, and electrodiffusive, sintering of materials. High frequency vibrations of the contacting metal, interruptions in the thermo electric circuits transmitting current, produce a potentiality for natural electric microerosion of rubbing surfaces. GRA

N72-18516# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROBLEMS CONNECTED WITH HARDENING OF CHROMIUM-RICH Ni-Cr ALLOYS

P. Hoch, V. Masarik, and V. Cihal 22 Sep. 1971 25 p refs Transl. into ENGLISH from Strojirenstvi (Prague), v. 20, no. 7, 1970 p 419-427
(AF Proj. 7351)
(AD-733807; FTD-HC-23-384-71) Avail: NTIS CSCL 13/8

The authors describe the properties of alloys containing from 30 to 60 percent of Cr. They have carried out a series of experiments to find out whether such materials can be used for manufacturing gas turbine blades, which must combine heat resistance with the resistance to vanadium corrosion. The results of experiments show the limits, within which materials with high Cr content can be used to advantage. Author (GRA)

N72-18517# Air Force Systems Command, Wright-Patterson AFB, Ohio.
FORCED FEED AS A MEANS OF ESTIMATING RELIABILITY AND SERVICE LIFE OF HYDRAULIC MACHINERY AND ASSEMBLIES
A. A. Komarov and Yu. S. Urbanskii 19 Jul. 1971 15 p refs Transl. into ENGLISH from the publ. "Teoriya Pnevmo i Gidroprivoda" Moscow, Izd-vo Nauka, 1969 p 198-204
(Contract F33657-71-D-0057; AF Proj. 7343)
(AD-731642; FTD-HC-23-349-71) Avail: NTIS CSCL 01/3

A study is made of aircraft reliability. Reliability of existing designs was estimated by interpretation of statistical data collected in running aircraft, and also by conducting special laboratory tests. The method of forced tests is one modification of physical modeling. This method determines characteristics of the test object from report data secured during experimental study of the model. Author (GRA)

N72-18518# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
WEAR OF A Z TYPE COUPLING OF TURBINE ROTOR BLADES
V. N. Makarov Dec. 1969 13 p refs Transl. into ENGLISH from Energomashinostr. (Moscow), v. 15, no. 2, 1969 p 36-37
(AF Proj. 7343)
(AD-731645; FTD-MT-24-48-71) Avail: NTIS CSCL 13/7

The experimental investigation of the wear resistance of blade stabilizing elements in the form of bolts connecting the overlapping leading and trailing edges of adjacent blade tips is given. The blades were made from 25N3 steel (HB 212 to 223). Bolts measuring 6.5, 8, and 10 mm in diameter were made of annealed 1Kh13 steel (HB 200 to 210), while 12 mm diameter bolts were made from 2Kh13 steel (HB 285 to 290). It proved possible to improve the wear resistance of the bolts by minimizing the clearance between the bolt and the blade, by rounding the edges of the holes in the blades, and by increasing the hardness of the bolt material. The bolt diameter had practically no influence on the wear of the blades. GRA

N72-18519# Picatinny Arsenal, Dover, N.J.
DEVELOPMENT OF IMPROVED MAGNETIC PARTICLE INSPECTION PROCEDURES
Edward F. Bauer Sep. 1971 26 p
(AD-733910; PA-TR-4156) Avail: NTIS CSCL 14/2

Current magnetic particle inspections for surface and near-surface flaws in ferromagnetic parts are dependent on human observations, decisions and errors. An improvement on this would be a semi-automatic device for detection and decision making that could remove the human error. This report is concerned with the development of such a device and the determination of its feasibility. Scanning of the surface of interest is accomplished mechanically using a simple XY table and fiber optics. The signals from the fluorescent particles are detected by means of a photomultiplier tube. The problems with interfering visible light were controlled with selective optical fibers. This project has demonstrated the basic feasibility of detecting fluorescent indications. Author (GRA)

N72-18520# Energy Research Corp., Bethel, Conn.
HYDROGEN GENERATOR ASSEMBLIES Final Report, Mar. 1970 - Mar. 1971
Richard Engdahl and E. S. Tillman, Jr. Sep. 1971 70 p refs
(Contract DAAB07-70-C-0153; DA Proj. 1G6-63702-DG-10)
(AD-733931; ECOM-0153-F) Avail: NTIS CSCL 13/7

The objective of the work was to evaluate design criteria for a simplified hydrogen generator for a 500 watt fuel cell. The hydrogen is produced by the catalytic steam reforming of vaporized JP-4 fuel with subsequent purification through a palladium-silver separator. The experimental studies were performed on a breadboard type system. This system contained all of the major sub-components required in an actual portable unit for field use. GRA

N72-18521# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
RADIAL GAS BEARING WITH AN ANNULAR PRESSURIZATION LINE
N. D. Zablotskii 12 Aug. 1971 13 p refs Transl. into ENGLISH from Aerotermodinam., TR. (USSR), no. 313, 1970 p 101-105
(AF Proj. 7343)
(AD-731890; FTD-HC-23-380-71) Avail: NTIS CSCL 13/9

Solution of the problem of determining the bearing capacity of a radial gas bearing with an injection line through which gas is fed into the lubricating layer. Two methods of feeding gas through the injection line are considered: (1) Feeding the gas directly into the lubricating layer without throttling, and (2) Feeding the gas into an annular groove with throttling. In both cases the pressure at the entrance to the lubricating layer does not depend on the peripheral coordinate. A solution to the Reynolds Equation is obtained by the Galerkin Method. Formulas for calculating the bearing capacity are presented. Author (GRA)

16 MASERS

Includes applications of masers and lasers. For basic research see: 26 Physics, Solid State.

N72-18522# Brussels Univ. (Belgium).
HOLOGRAPHY: THEORETICAL AND EXPERIMENTAL APPROACH, PART 1
Yves Rezette Sep. 1970 63 p refs In FRENCH; ENGLISH summary
(Rept-12-1970) Avail: NTIS

A theoretical approach is presented to holography, based on diffraction formulas using the theory of Fourier transform. The reconstruction of a source point is given in terms of sine functions. Starting from the holographical interferometry, a method is proposed for numerical analysis of the fringes. Author

N72-18523*# ITT Gilfillan, Inc., San Fernando, Calif. Advanced Engineering Development Dept.
CONSTRUCTION AND TESTING OF A SCANNING LASER RADAR (SLR), PHASE 2 Final Report
Terry Flom and H. Dean Coombes Dec. 1971 127 p
(Contract NAS8-20833)
(NASA-CR-123530) Avail: NTIS CSCL 20E

The scanning laser radar overall system is described. Block diagrams and photographs of the hardware are included with the system description. Detailed descriptions of all the subsystems that make up the scanning laser radar system are included. Block diagrams, photographs, and detailed optical and electronic schematics are used to help describe such subsystem hardware as the laser, beam steerer, receiver optics and detector, control and processing electronics, visual data displays, and the equipment used on the target. Tests were performed on the scanning laser radar to determine its acquisition and tracking performance and to determine its range and angle accuracies while tracking a moving target. The tests and test results are described. Author

N72-18524*# Techtran Corp., Glen Burnie, Md.
APPLICATION OF LASER TECHNIQUES TO STUDIES OF SEMICONDUCTORS
L. Kowalczyk Washington NASA Feb. 1972 14 p refs Transl. into ENGLISH from Postepy Fiz. (Poland), v. 22, no. 4, 1971 p 407-418
(Contract NASw-2031)
(NASA-TT-F-14119) Avail: NTIS CSCL 20E

The experimental results obtained from studies of optical mixing and higher harmonic generation by free carriers in semiconductors, using a CO2 laser, are presented. Enhancement of nonlinear optical effects due to the resonance in strong magnetic fields was observed. The effect of inelastic scattering of the laser radiation caused by electrons in magnetic Landau levels in semiconductors is discussed. Author

N72-18525*# Massachusetts Inst. of Tech., Cambridge. Research Lab. of Electronics.

VARIABLE-RATE OPTICAL COMMUNICATION THROUGH THE TURBULENT ATMOSPHERE Ph.D. Thesis

Barry K. Levitt 20 Aug. 1971 98 p refs
(Grant NGL-22-009-013; Contract DA-28-043-AMC-02536(E))
(NASA-CR-125632; TR-483) Avail: NTIS CSCL 20E

It was demonstrated that the data transmitter can extract real time, channel state information by processing the field received when a pilot tone is sent from the data receiver to the data transmitter. Based on these channel measurements, optimal variable rate techniques were derived and significant improvements in system perforamnce were obtained, particularly at low bit error rates. Author

N72-18526# Rome Air Development Center, Griffiss AFB, N.Y.

LASER RADAR CROSS-SECTION AND REFLECTIVITY MEASUREMENTS AT .48, .63, AND 10.6 MICRONS

Fred J. Demma and James H. Michels Nov. 1971 46 p refs
(AD-733345; RADC-TR-71-245) Avail: NTIS CSCL 17/8

The effect of target surface and shape, on the power reflected from it, as a function of aspect angle theta, has been investigated at 0.48, 0.63, and 10.6 microns in a laboratory environment. In particular, at 0.48 micron the reflected wave amplitude was measured relative to a standard cross section target, a Lambertian Reflector. This enabled the determination of actual Laser Radar Cross Section (LRCS) values for these targets. Further, the experimental results obtained were found to agree closely with analytical predictions based on specular scattering theory. Author (GRA)

N72-18527# Rome Air Development Center, Griffiss AFB, N.Y.

RADC LASER PROPAGATION PROGRAM, SEPTEMBER 1971

Raymond P. Urtz, Jr., August J. Huber, Jr., and William H. Dungey Nov. 1971 73 p refs
(AD-733346; RADC-TR-71-252) Avail: NTIS CSCL 20/6

The report summarizes the status of the in-house portion of the RADC Laser Propagation Program being conducted in support of ARPA/STO. Results are presented of theoretical predictions for the phase structure function for 10.6 micron laser radiation. Experimental data are given for phase structure function measurements for path lengths of 300 meters and a wavelength of 10.6 microns. Micrometeorological data are also presented for Ct and outer scale of turbulence. Author (GRA)

N72-18528# Maryland Univ., College Park. Dept. of Electrical Engineering.

THE STUDY OF THE INTERACTION OF INTENSE PICOSECOND LIGHT PULSES WITH MATERIALS. MODE LOCKED LASERS Quarterly Technical Report, 22 Jun. - 21 Sep. 1971

Chi H. Lee 15 Oct. 1971 24 p refs
(Grant DA-ARO(D)-31-124-71-G55; ARPA Order 675)
(AD-733438; AROD-8921-1-P) Avail: NTIS CSCL 20/5

Recent advance in the development of mode-locked lasers is reviewed. In particular the principle of generation and the measurement of the picosecond pulses are discussed. Recent measurements on the spectral and temperal characteristics are included. This data can be used to explain some of the discrepancy found in previous measurements. The application of picosecond pulse for lifetime measurement in semiconductors is also discussed. Author (GRA)

N72-18529# Cornell Aeronautical Lab., Inc., Buffalo, N.Y. Aerodynamic Research Dept.

CHEMICAL LASER RESEARCH Final Report, 1 Nov. 1970 - 31 Oct. 1971

John W. Daiber Oct. 1971 33 p refs
(Contract N00014-71-C-0157; NR Proj. 016-405)
(AD-733668; CAL-RF-3026-A-1) Avail: NTIS CSCL 20/5

The purpose of this program was to conduct theoretical and experimental research for the development of new chemical lasers. Initial emphasis was on the pumping of hydrogen cyanide by the transfer of vibrational energy from hydrogen fluoride produced by burning hydrogen in fluorine. A second reaction that was studied involved the reaction of hydrogen with ozone to produce vibrationally excited hydroxyl radicals. Author (GRA)

N72-18530# Holobeam, Inc., Paramus, N.J.

SECOND HARMONIC GENERATION Final Technical Report, 1 Sep. 1970 - 3 Aug. 1971

James H. Boyden, Edward G. Erickson, James E. Murray, and Robert Webb Oct. 1971 87 p refs
(Contract N00014-71-C-0044; ARPA Order 306)
(AD-733050; Holobeam-3212) Avail: NTIS CSCL 20/5

The investigations under the subject contract had the objectives of producing high average powers in a Second Harmonic Generation laser system at a wavelength of 0.532 microns with a short pulse and high repetition frequency format. The program's objectives were to be achieved by using a high average power CW Nd:YAG laser combined with electro-optical Q-switching techniques and mode-locked pulse injection as a source of 1.065 micron power drive to a nonlinear crystal. Both well known and new materials were investigated in order to achieve high conversion efficiencies. Damage and the thermal failure of materials was an area of special concern in this program. Author (GRA)

N72-18531# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

PROGRESS IN HOLOGRAPHY

Ya. A. Smorodinskii and L. M. Soroko 9 Sep. 1971 60 p refs Transl. into ENGLISH from Usp. Golografii (USSR), no. 5, 1970 p 1-48
(Contract F33657-71-D-0057)
(AD-733204; FTD-HC-23-338-71) Avail: NTIS CSCL 14/5

The report concerns the problem of how to record light so that a maximum amount of information about a given object will be captured. The properties of light in the form of a wave, rays, or light quanta are considered separately from the others only under certain conditions, since sometimes the quantum properties may in a completely unexpected way change into wave-like properties, and a light ray may just as unexpectedly manifest purely wave-like characteristics. The properties of a light receiver are studied, especially the properties of a photographic film. Author (GRA)

N72-18532# Michigan State Univ., East Lansing. Dept. of Chemistry.

A CONSIDERATION OF THE RUBY LASER-INDUCED DECOMPOSITION OF AZOETHANE

D. L. Rousseau (Bell Telephone Labs., Inc., Murray Hill, N. J.), W. E. Falconer (Bell Telephone Labs., Inc., Murray Hill, N. J.), and G. E. Leroi Nov. 1971 14 p refs Submitted for publication Work performed in part at Princeton Univ.
(Contract N00014-68-A-0109-0009; NR Proj. 014-503)
(AD-733485; TR-5) Avail: NTIS CSCL 07/5

Ruby laser-induced decomposition of azoethane gave products different from the near UV photodissociation. Therefore, although in some experiments product yields varied quadratically with laser power, the principal dissociation was not via two-photon photoexcitation. The two-photon photodissociation cross-section was found. Author (GRA)

N72-18533# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.

ANALYTICAL PROGRAM FOR CONTINUOUS WAVE

CHEMICAL LASER DEVICE Final Report, 18 Feb. - 18 Oct. 1971
Jurgen Thoenes, Alan W. Ratliff, and John W. Benefield
Redstone Arsenal, Ala. AMC Jul. 1971 110 p refs
(Contract DAAH01-71-C-0680; DA Proj. 1T0-61101-A-91-A)
(AD-733356; LMSC/HREC-D225341; RK-TR-71-19) Avail: NTIS CSCL 20/5

Combustion of deuterium and fluorine in a preburner, finite rate supersonic expansion of the reaction products, and finite rate mixing between parallel, supersonic streams of preburner reaction products and hydrogen-carbon dioxide mixtures are analyzed to establish design criteria for a small continuous wave HF and/or HF-CO2 transfer laser. Parametric variations of preburner and secondary injectant total pressures, mixture ratios, relative nozzle sizes and expansion ratios resulted in the selection of optimum nozzle arrangements and operating conditions for the generation of HF or CO2 population inversions, and thus potential power output, from the laser cavity.
Author (GRA)

N72-18534# California Univ., La Jolla. Inst. for Pure and Applied Physical Sciences.
KINETIC PROCESSES IN NOBLE GAS ION LASERS Ph.D. Thesis
Chuan-Cheng Chen Nov. 1971 216 p refs
(Contracts F44620-68-C-0010; DA-31-124-ARO(D)-257; Proj. THEMIS; AF Proj. 7921)
(AD-733587; IPAPS-70/71-059) Avail: NTIS CSCL 20/5

A quantitative theory is proposed for calculation of the state of the plasma and various electronic excitation rates in high-current low pressure discharges typical of noble gas ion laser operation under quasi-steady state, constant-pressure or constant-density conditions. At present, only wall-confined discharges in the absence of any externally applied magnetic fields is considered. For simplicity, multiple ionization is also neglected. The discharge is formulated as a three-temperature problem with significant axial electron drift. It is found that the natural similarity parameters in such a discharge are pR(the product of the total filling gas pressure p and the discharge tube radius R), and jR (the product of current density j and the tube radius).
Author (GRA)

N72-18535# Stanford Research Inst., Menlo Park, Calif.
OCULAR LASER THRESHOLD INVESTIGATIONS Final Report, 1 Sep. 1969 - 31 Dec. 1970
Arthur Vassiliadis, H. Christian Zweng, and Kent G. Dedrick Jan. 1971 66 p refs
(Contract F41609-70-C-0002; SRI Proj. 8209)
(AD-731577) Avail: NTIS CSCL 20/5

Results of experimental investigations to determine threshold levels for doubled neodymium and ruby lasers are presented. The experimental animals were rhesus monkeys. Threshold levels for retinal damage caused by the doubled long-pulsed and Q-switched neodymium laser are reported, and results of experiments to determine retinal damage and lens damage caused by the Q-switched ruby laser are presented. In addition, theoretical considerations and calculations for retinal damage are discussed and compared with experimental results.
Author (GRA)

N72-18536# Boston Univ., Mass. Dept. of Physics.
KINETIC EQUATIONS FOR LASERS AND OPTICAL PUMPING Final Report, 1 Feb. 1968 - 31 Jan. 1971
Charles R. Willis 25 Jun. 1971 23 p
(Contract F19628-68-C-0199)
(AD-734064; AFCRL-71-0379) Avail: NTIS CSCL 20/5

Under the present contract the authors have developed and extended previous work on the description and understanding of laser behavior from a fundamental microscopic point of view and we have generalized the previous work to include multimode effects, pulse propagation, collision effects in gas lasers and a more exact treatment of the radiation matter interaction in a quantum Boltzman equation for the laser. In addition the authors used a general approach to the laser problem to derive and develop kinetic equations for optical pumping which contain existing theories as limiting cases and go beyond present theories in the treatment of radiation. This report consists of the abstracts of papers published in physics journals and books, abstract of talks presented at American Physical Society meetings and abstracts of Ph.D. theses completed during the present contract.
Author (GRA)

N72-18537# Army Electronics Command, Fort Monmouth, N.J.
LASER SPECTRAL OUTPUT OF Er(3 PLUS) IN PHOSPHATE GLASS
Gregory R. Osche Sep. 1971 18 p refs
(DA Proj. 1S6-62705-A-056)
(AD-733907; ECOM-3488) Avail: NTIS CSCL 20/5

The competition of the 1.536 micrometers and the 1.543 micrometers laser lines of erbium in zinc alumino phosphate glass is reported. Experimental results show that the 1.536 micrometers line oscillates under high loss conditions whereas the 1.543 micrometers line oscillates under low loss conditions. The interaction of the two lines is attributed to the existence of common upper laser levels while the cavity loss dependence is attributed to the small cross section but somewhat greater four-level character of the longer wavelength. Both Q-switch and long pulse data are included.
Author (GRA)

N72-18538# Army Electronics Command, Fort Monmouth, N.J.
GAIN MEASUREMENTS AND BEAM CHARACTERISTICS OF A 100-WATT ARGON-ION LASER
Elliot F. Wayner, Roland H. Wright, Jr., and Stephen Levy Sep. 1971 28 p refs
(AD-733904; ECOM-3470) Avail: NTIS CSCL 20/5

The small-signal gain and beam characteristics of a 100-watt cw argon-ion laser were studied. The laser tube was constructed using a graphite disk design with a 6.35-mm bore and a 100-in. active length. The tube was built in two identical sections that are joined at their respective anodes to minimize window degradation. The maximum small-signal gains for three primary laser lines were measured to be 1.07/m at 488 nm, 0.335/m at 514.5 nm, and 0.305/m at 476.5 nm. The saturation mechanisms for the small-signal gain and output power are discussed. The multitransverse-mode beam divergence for the 488-nm and 514.5-nm lines was measured as 1.1 mrad full angles, which is a factor of two greater than the calculated passive cavity value for the TEM(oo) mode. A strong mode interaction was observed under certain conditions on the frequency spectrum of the 488-nm line.
Author (GRA)

N72-18442# National Bureau of Standards, Washington, D.C.
LASER RADIOMETRY
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 511-521 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

17 MATERIALS, METALLIC

Includes cermets; corrosion; physical and mechanical properties of materials; metallurgy; and applications as structural materials. For basic research see: 06 Chemistry. For related information see also: 18 Materials, Nonmetallic; and 32 Structural Mechanics.

N72-18539# Central Electricity Generating Board, London (England).
BRITTLE FRACTURE OF METALS: A SELECTED BIBLIOGRAPHY, 1960 OCTOBER 1971
P. G. Williams, (comp.) Dec. 1971 23 p refs
(CE-Bib-151.1) Avail: NTIS

A selective bibliography on brittle fracture of steels is presented. The collection contains 103 references and considers mainly pressure vessel and welded joint structures. G.G.

N72-18540# Central Electricity Generating Board, London (England).
NITRIDING OF STEEL: A SELECTIVE BIBLIOGRAPHY, 1923 - OCTOBER 1971
P. G. Williams, comp. Feb. 1971 30 p refs
(CE-Bib-5) Avail: NTIS

A selective bibliography on nitriding of steels is presented. The collection contains 103 references on the iron-nitrogen processes. G.G.

N72-18541*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
HOT-SALT STRESS-CORROSION OF TITANIUM ALLOYS AS RELATED TO TURBINE OPERATION
Hugh R. Gray 1972 12 p refs Proposed for presentation at 20th Intern. Conf. on Titanium, Cambridge, Mass., 2-5 May 1972; sponsored by Met. Soc. and the Am. Soc. for Metals
(NASA-TM-X-68015; E-6802) Avail: NTIS CSCL 11F

In an effort to simulate typical compressor operating conditions of current turbine engines, special test facilities were designed. Air velocity, air pressure, air dewpoint, salt deposition temperature, salt concentration, and specimen surface condition were systematically controlled and their influence on hot-salt stress-corrosion evaluated. The influence of both continuous and cyclic stress-temperature exposures was determined. The relative susceptibility of a variety of titanium alloys in commonly used heat-treated conditions was determined. The effects of both environmental and material variables were used to interpret the behavior of titanium alloys under hot-salt stress-corrosion conditions found in jet engines and to appraise their future potential under such conditions. Author

N72-18542# Joint Publications Research Service, Washington, D.C.
EFFECT OF PROCESS REGIMES OF HIGH TEMPERATURE THERMOMECHANICAL WORKING ON STATIC AND FATIGUE STRENGTH OF HEAT RESISTANT ALLOYS
D. Ya. Bragin, I. N. Shkanov, I. P. Goldfarb, and N. V. Khabibullina 10 Feb. 1972 7 p refs Transl. into ENGLISH from Tekhnol. Organizatsiya Proizv., no. 6, 1970 p 94-96
(JPRS-55154) Avail: NTIS

A test was made of the fatigue strength of parts made from the alloy khN70MVTBYu subjected to high-temperature thermomechanical processes. The effects of deformation and heating temperature during stamping of the alloy was investigated in relation to long-term heat resistance and fatigue at elevated temperatures. Long-term heat resistance tests based on 100-hour runs were conducted to determine the temperature limit for weakening, using variants of the high-temperature process, compared to the total heat treatment regime of the alloy. Fatigue strength was studied at final reduction temperature in the high-temperature process (800 C) and at maximum temperature for alloy test parts (650 C). The strengthening effect was somewhat diminished at 800 C compared with the lower temperature. K.P.D.

N72-18543*# Techtran Corp., Glen Burnie, Md.
ANALYTICAL BEHAVIOR OF VERY SMALL AMOUNTS OF CHROMIUM, PART 2
Klaus Beyermann Washington NASA Mar. 1972 39 p refs Transl. into ENGLISH from Z. Anal. Chem. (Berlin), v. 191, no. 5, 1962 p 346-369
(Contract NASw-2037)
(NASA-TT-F-14142) Avail: NTIS CSCL 11F

The determination of nonogram up to microgram amounts of Cr by microcolorimetry in capillary cuvettes, by emission spectrography, by flame photometry, by X-ray emission spectrography, by polarography, by biamperometric measurement on gold electrodes, and by activation analysis are described. Author

N72-18544# Permanent Magnet Association Central Research Lab., Sheffield (England).
COBALT ALLOY PERMANENT MAGNETS
J. E. Gould Brussels Centre d'Inform. du Cobalt Dec. 1971 88 p refs
Avail: NTIS

The metallurgical and physical background of Alnico alloy properties are considered, and the composition, treatment, and properties of cobalt magnet steels are summarized. Several other cobalt alloy systems are discussed, which have useful permanent magnet properties for specialized purposes, including such materials as Remalloy, Vicalloy, Cunico, cobalt-platinum alloys, and Malcalloy. Permanent magnet materials are discussed, which are synthesized from fine particles produced by chemical reduction as in the Ugine process) or by controlled electrolysis to give elongated single-domain particles (such as Lodex materials). Cobalt-rare earth alloy particles are also described, having superior permanent magnet properties. Applications of the materials discussed and the factors that control their magnetic stability in service are reviewed. Author

N72-18545# Cranfield Inst. of Technology (England). Dept. of Materials.
METALS FOR AEROSPACE APPLICATIONS
P. Hancock. and B. S. Hockenhull Oct. 1971 29 p refs
(Cranfield-Mat-6) Avail: NTIS

Metals available currently in two parts, one dealing with structural aerospace applications at relatively low temperatures and one dealing with the high temperature aerospace field are reviewed. It is shown that the last decade or so has produced improvements mainly in the specific strength of titanium alloys and steels, the latter showing very considerable improvements but without significant improvement in specific modulus. Superalloys were further developed to the status that compromise is now sought between the creep properties and the oxidation resistance with upper working temperatures in the region of 1250 C. Above this temperature, the refractory metals have superior strength properties but all suffer poor resistance to oxidation. Author

N72-18546# Union Carbide Corp., Oak Ridge, Tenn. Y-12 Plant.
OXIDATION PROPERTIES OF TWO URANIUM ALLOYS (U-16.6 AT. PERCENT Nb-5.6 AT. PERCENT Zr AND U-21 AT. PERCENT Nb)
J. V. Cathcart, R. E. Pawel, and G. F. Petersen 26 Oct. 1971 37 p refs
(Contract W-7405-eng-26)
(Y-1800) Avail: NTIS

The fundamental oxidation characteristics of two uranium-base alloys (U-16.6 at. percent Nb-5.6 at. percent Zr and U-21 at. percent Nb) in the temperature range from 500 to 1,000 C in oxygen at 0.05 torr have been determined. Both alloys undergo large dimensional changes during oxidation at temperatures above 650 C due to stresses generated in the oxide during oxidation. Stresses estimated at one million psi are shown to develop in the oxidizing specimens. A mechanism for the generation of these stresses was proposed. Author (NSA)

N72-18547# Data Corp., Dayton, Ohio.
APPLICATION OF DIGITAL TECHNIQUES TO MICROSTRUCTURE ANALYSIS OF MATERIALS Final Report, Aug. 1970 - Jul. 1971
P. J. Caulfield Wright-Patterson AFB, Ohio ATML Oct. 1971 116 p refs
(Contract F33615-70-C-1586; AF Proj. 7351)
(AD-733712; FR-71-4; AFML-TR-71-214) Avail: NTIS CSCL 11/6

The primary objective of this project was to develop digital computer techniques for the quantitative characterization of alloy microstructures. A secondary objective was to utilize these quantities to determine the numerical correlations between processing parameters, microstructure appearance, and mechanical properties. These objectives were restricted in scope to the 6Al-2Sn-4Zr-6Mo titanium alloy. To these ends, computer programs were written to: (1) Perform separation of individual connected regions from the background in a digitized micrograph; (2) compute 34 quantities which describe geometric properties of the photomicrograph; and (3) correlate these 34 quantities with 8 mechanical property measurements for each of 57 alloy specimens. The results of applying these programs to 439 photomicrographs of two perpendicular views of the alloy are given. Author (GRA)

N72-18548# Lafayette Coll., Easton, Pa.

RESPONSE OF THE DELTA TEST TO SPECIMEN VARIABLES Final Report

Leon J. McGeady Washington Coast Guard 1971 53 p refs
(Contract N00024-69-C-5463)
(AD-733086; SSC-221) Avail: NTIS CSCL 11/6

The Delta specimen was applied to two different heats of A517 grade steel in one inch plate thickness and to the one heat in 1/2 and 2 inch plate thickness. Various modifications of the basic specimen were investigated, a non-standard geometry and a composite form of the specimen into which different steel types were incorporated. The influences of various welding procedures were examined as well as the performance of all steels in the non-welded condition. The specimen was found applicable and appropriate for all conditions tested, showing sensitivity to all variables. At the same time the specimen showed a consistency in behavior which could be rationalized with commercial experience and data from corollary tests. The steels examined showed several transitional behaviors when tested as weldments, these transitions occurring in place of fracture, length of fracture, load carrying changes and overall ductility measured by deflection at failure. Author (GRA)

N72-18549# Carnegie-Mellon Univ., Pittsburgh, Pa. Metals Research Lab.

STRUCTURE AND PROPERTIES OF IRON BASE ALLOYS Final Report, Sep. 1969 - Aug. 1971

Harold W. Paxton 1 Nov. 1971 9 p refs
(Contract N00014-67-A-0314-0004; NR Proj. 031-707)
(AD-733084) Avail: NTIS CSCL 11/6

The results of microstructural variations on the toughness and resistance to stress corrosion cracking of three maraging steels are described. The heat treatments were designed to produce a constant yield strength with widely varying microstructures. Author (GRA)

N72-18550# Battelle Memorial Inst., Columbus, Ohio.

OXIDATION AND HOT CORROSION OF Ni-Cr- AND Co-Cr BASE ALLOYS CONTAINING RARE EARTH OXIDES DISPERSIONS Final Report, 3 Aug. 1970 - 3 Aug. 1971

John Stringer, Ian G. Wright, Ben A. Wilcox, and Robert I. Jaffee 20 Oct. 1971 133 p refs
(Contract N00019-71-C-0079)
(AD-733465) Avail: NTIS CSCL 11/6

The effects of rare earth oxide (REO) dispersions, Y2O3, and CeO2, on the oxidation and hot corrosion characteristics and mechanisms of Ni-Cr- and Co-Cr-base alloys were studied. Primary emphasis was directed toward a detailed investigation of Ni-20w/oCr-3v/o REO and Co-21w/oCr-3v/o REO alloys prepared by attritor milling, and preliminary oxidation results were obtained on Co-Cr-Al-Y2O3 alloys. It was found that REO particles had four effects on the oxidation behavior of Ni-Cr and Co-Cr alloys: (1) They promote the selective oxidation of chromium to form a continuous protective Cr2O3 scale; (2) The rate of growth of Cr2O3 is reduced compared with particle-free alloys; (3) Cr2O3 oxide scale growth is inward in dispersion alloys compared with outward growth in particle-free alloys; (4) Oxide scale adhesion is improved. A kinetic analysis was developed to account for the oxidation behavior and a model of scale growth is presented. Author (GRA)

N72-18551# Battelle Memorial Inst., Columbus, Ohio. Metals and Ceramics Information Center.

EFFECTS OF SURFACE CONDITION ON THE MECHANICAL PROPERTIES OF TITANIUM AND ITS ALLOYS

D. N. Williams and R. A. Wood Aug. 1971 74 p refs
(AD-732248; MCIC-71-01; LC-75-180873) Avail: NTIS CSCL 11/6

The report reviews the available literature on the effects of commonly encountered surface conditions on the properties of titanium and its alloys. The material properties of major concern include fatigue strength, tensile strength and ductility, and bend ductility. Author (GRA)

N72-18552# General Motors Research Labs., Warren, Mich. Materials and Structures Lab.

HIGH PRESSURE SHOCK WAVE ATTENUATION Final Report

Allan R. McMillan Jun. 1971 83 p refs
(Contract A-49-146-XZ-322; ARPA Order 560)
(AD-733490; MSL-70-01; DASA-2425) Avail: NTIS CSCL 11/6

The attenuation of high pressure shock waves has been investigated. High purity copper, 6061-T6 aluminum, 6Al-4V and alpha phase titanium, an uranium alloy and two alloys of beryllium were examined experimentally at pressures as high as 3 megabars. Low pressure experiments were instrumented with a velocity laser interferometer. Intermediate pressures (to several hundred kilobars) were instrumented with manganin wire piezoresistive gages and high pressure measurements were made through observation of free surface velocities. The results show that evidence of strength, as exhibited by elastic release wave behavior, persists to pressures of hundreds of kilobars and that the release wave structure is not elastic-perfectly plastic. For the materials examined the release wave structures can be described as exhibiting a Bauschinger effect. For megabar pressures (beyond melting behind the shock front) fluid behavior is indicated by the lack of an elastic release wave. Author (GRA)

N72-18553# Army Materials and Mechanics Research Center, Watertown, Mass.

TORQUES ON SINGULAR SURFACES

Gordon A. Bruggeman and George H. Bishop, Jr. Jul. 1971 13 p
(DA Proj. 1T0-61102-B-32-A)
(AD-733303; AMMRC-TR-71-19) Avail: NTIS CSCL 11/6

The concepts involved in expressing the surface torques on singular surfaces which correspond to cusps in the gamma-plot of surface energy versus surface inclination are clarified and extended. For equilibrium morphologies formed by faceting, it is demonstrated that the torque displayed by a singular surface is a property of the particular state of interfacial equilibrium in which the torque is measured. The magnitude of the effective torque will in general lie between the limiting values of the angular derivatives at the cusp corresponding to the singular surface on the appropriate two-dimensional section through the gamma-plot (the gamma sub 2-plot). An extension of a construction due to Gjostein is presented by which the effective torques may be obtained for equilibrium morphologies resulting from linear faceting when the shape of the gamma sub 2-plot is known. This is illustrated with several examples involving singular surfaces, including that of faceted -10(-1)0 = grain boundaries in zinc. Author (GRA)

N72-18554# Aerospace Corp., Hawthorne, Calif.

THE EFFECT OF MICROSTRUCTURE ON FATIGUE CRACK PROPAGATION IN Ti-6Al-6V-2Sn ALLOY, SEPTEMBER 1970 - JUNE 1971

Maurice F. Amateau, W. Dave Hanna, and E. George Kendall 20 Oct. 1971 43 p refs
(Contract F04701-71-C-0172)
(AD-733335; TR-0172(2250-10)-3; SAMSO-TR-71-268) Avail: NTIS CSCL 11/6

The fatigue crack growth behavior of Ti-6Al-6V-2Sn was investigated for five different microstructures, using contoured double-cantilever beam specimens. The fatigue crack growth behavior was compared with the mechanical strength, toughness, and ductility properties for each microstructure. The fatigue fracture surfaces were examined with a scanning electron microscope. Annealed structures consisting of equiaxed primary alpha have the lowest crack growth resistance, while the acicular alpha microstructure resulting from beta annealing has a growth resistance four times greater in the intermediate growth regime. No simple model of crack growth rate using gross mechanical properties describes the relative magnitude nor the ralative order of crack resistance among the different microstructures.
Author (GRA)

N72-18555# Naval Research Lab., Washington, D.C.
ARPA COUPLING PROGRAM ON STRESS CORROSION CRACKING, SECOND EDITION Final Report
B. F. Brown 27 Oct. 1971 200 p Revised
(ARPA Order 878; NRL Proj. M04-08A)
(AD-733442; NRL-7329) Avail: NTIS CSCL 11/6

The technical background, organization, and modus operandi of the ARPA coupling program on stress-corrosion cracking are summarized. The problem of interpreting the data from smooth stress-corrosion cracking specimens is discussed. This is followed by a summary of technical achievement highlights in narrative from treating specimen types, titanium alloys, high strength steels, aluminum alloys, and surface sciences. An Abstracts of Achievements section is the most important part of this report, for it gives not only indications of technical contributions but the literature citations where the interested reader can examine the detailed account of a given topical area. Author (GRA)

N72-18556# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
CRITICAL BEHAVIOR OF METALLIC IMMISCIBLE LIQUID BINARY SYSTEMS Ph.D. Thesis
H. Konrad Schuermann Jul. 1971 166 p refs
(Contract N00014-67-A-0398-0010)
(AD-733413; TR-1) Avail: NTIS CSCL 11/6

Different aspects of the critical behavior of the metallic binary systems Ga-Hg and Li-Na have been investigated experimentally. In the Ga-Hg system the coexistence curve was determined by measuring the electrical resistivities of the two distinct layers of the liquid mixture which are established below the critical temperature T(c). The specific heat at constant pressure, c(p), shows an anomaly at the temperature of phase separation. The results show that in the critical region the liquid metallic binaries do not behave qualitatively different than the nonconducting immiscible binaries. In the Li-Na system the temperature derivative of the resistivity of the homogeneous mixture increases rapidly as T(c) is approached from above showing an anomaly like c(p). Author (GRA)

N72-18557# Connecticut Univ., Storrs. Dept. of Metallurgy.
CRACK OPENING DISPLACEMENT AND THE RATE OF FATIGUE CRACK GROWTH
Raymond J. Donahue, Hector M. Clark, Phillip Atanmo, Raghvir Kumble, and Arthur J. McEvily Jul. 1971 29 p refs
(Contract F44620-69-C-0011; AF Proj. 17921)
(AD-733369; UC-MET-5-71; AFOSR-71-1946TR) Avail: NTIS CSCL 11/6

Using a direct proportionality between the rate of fatigue crack growth and crack opening displacement above a threshold, it is shown that fatigue crack growth data for a wide variety of different materials can be accurately described in terms of the mechanical properties and two material constants; the constant of proportionality A and the threshold stress intensity factor K sub th. Some 65 sets of data for tests at R approximately equal to O were analyzed by computer and it is shown that the approach is valid to growth rates up to about 0.0001 in./cycle, i.e. until the onset of crack propagation by dimple formation. It is found that A can be related to the yield strain for crack growth in non-aggressive environments, and is increased by increasingly severe environments, while K sub th is decreased. Crack growth rate is independent of the yield stress and proportional to the strain intensity factor above the threshold. Author (GRA)

N72-18558# Naval Ship Research and Development Center, Annapolis, Md. Materials Dept.
MICROSTRUCTURE AND STRENGTH PROPERTIES OF UNIDIRECTIONALLY SOLIDIFIED COBALT-NIOBIUM EUTECTIC ALLOY
John P. Gudas Nov. 1971 77 p refs
(AD-733677; NSRDL/A-8-918) Avail: NTIS CSCL 11/6

The room temperature mechanical properties of unidirectionally solidified Co-Co3Nb eutectic alloy have been studied. Solidification rates varying from 0.000128 cm/sec to 0.001764 cm/sec were employed in producing various microstructures. A well defined lamellar microstructure is produced at rates below 0.000317 cm/sec, while above this rate a lamellar-dendritic structure exists. Room temperature compression and hardness tests indicated increased strengthening with increasing solidification rate as well as verification of a Hall-Petch dependence of fracture stress and hardness upon interphase spacing. Brittle fracture in both types of structure was seen to be initiated by slip in the ductile Co3Nb phase and promoted by crack propagation in the brittle alpha-cobalt solid solution phase.
Author (GRA)

N72-18559# Pennsylvania Univ., Philadelphia. School of Chemical Engineering.
MATHEMATICS OF THE ELECTROCHEMICAL EXTRACTION OF HYDROGEN FROM IRON
Leonard Nanis and T. K. Govindah Namboodhiri Nov. 1971 21 p refs
(Contract N00014-67-A-0216-0004; NR Proj. 036-077)
(AD-733498; UPH2-TR-003) Avail: NTIS CSCL 11/6

The transient current of hydrogen removal from iron following steady state permeation is analyzed theoretically for two limiting conditions at the input of hydrogen diffusivity in iron. Author (GRA)

N72-18560# Naval Research Lab., Washington, D.C. Strength of Metals Branch.
PLANE STRESS FRACTURE RESISTANCE OF ONE STEEL SHEET AND TWO TITANIUM SHEET ALLOYS Final Report
A. M. Sullivan and C. N. Freed 27 Oct. 1971 20 p refs
(RR Proj. 007-01-46-5431)
(AD-733655; NRL-7332) Avail: NTIS CSCL 11/6

Three high-strength alloys have been investigated to determine the effect of the specimen geometric dimensions on the K sub c fracture toughness value. The alloys were 4130 steel and two titanium sheet alloys, Ti-6Al-4V and Ti-120 VCA. The influence of specimen thickness, crack length/width ratio, and yield strength on K sub c was studied. Author (GRA)

N72-18561# Army Foreign Science and Technology Center, Charlottesville, Va.
SCREENING OF A METAL SURFACE BY FRACTURE PRODUCTS GENERATED BY LOW DENSITY LASER RADIATION
G. S. Romanov and K. L. Stepanov 20 Oct. 1971 19 p refs
Transl. into ENGLISH from Zh. Prikl. Spektroskopii, Akad. Nauk Belorussk. SSR. (Minsk), v. 8, no. 5, May 1968 p 753-763
(FSTC Proj. T7023012301)
(AD-733768; FSTC-HT-23-1156-71) Avail: NTIS CSCL 71/6

The article covers a number of questions related to the phenomenon of damage to metals by laser radiation, in particular the attenuation of radiation incident to the surface being damaged due to its absorption by the damage products, the influence of unevenness of ionization and the population of atomic levels on the absorption of radiation, as well as the conditions under which the expansion of the material from the surface is adiabatic. The entire analysis was performed with a constant radiation flux density between 1 million T and 1 billion w/sq.cm, for which the stable thermal mechanism of damage is correct, while the body surface temperature T (0) reaches 1,000 to 10,000 degree K. The material is assumed to fly away from the surface evenly, and counterpressure of the external medium is not considered. Author (GRA)

N72-18562# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. POWDER METALLURGY
J. F. Joyce 12 Nov. 1971 3 p refs
(AD-733836) Avail: NTIS CSCL 11/6

Contents: Nickel-base alloys; Aluminum; Titanium; Stainless steel; Project Themis; Friction materials; Beryllium. Author (GRA)

N72-18563# Army Foreign Science and Technology Center, Charlottesville, Va.
HEAT TREATMENT AND PROPERTIES OF MARTINSITE-AGED STEEL TYPE 00N12K16M11
M. N. Bodyako, S. A. Astapchik, G. B. Yaroshevich, and V. M. Olefirenko 19 Oct. 1971 14 p refs Transl. into ENGLISH from Akad. Nauk Belorussk. SSR, Vestsi, Ser. Fiz.-Tekhn. Nauk. (Minsk), no. 1, 1970 p 47-53
(AD-733772; FSTC-HT-23-1136-71) Avail: NTIS CSCL 11/6

Studies were made of the heat treatment and properties of martensite-aged steel containing 12.4% nickel. It was shown that rapid, continuous heating allows a fine-grain structure to be produced in the 950-1, 200C interval. However, no subsequent aging modes can yield satisfactory plasticity. This indicates that the plasticity of Fe-Ni-Co-Mo alloys with high cobalt and molybdenum content is determined more by the continuity of grain boundaries and nature of separation of hardening phases than by grain size. GRA

N72-18564# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF VIBRATION FREQUENCY ON THE VIBRATIONAL CREEP PROCESS
Anatoliusz Jakowluk 18 Aug. 1971 24 p refs Transl. into ENGLISH from Mech. Teor. Stosow. (Poland), v. 7, no. 4, 1969 p 507-521
(AF Proj. 6010)
(AD-733804; FTD-HC-23-824-71) Avail: NTIS CSCL 11/6

The investigations were carried out on an aluminum alloy Al-Mg-Si (PA4) under an uniaxial state of stress at a temperature of 296K. The tests were performed with a given constant mean stress and various given stress amplitude coefficients. For the first stress amplitude coefficient, the frequencies of the given oscillating load were applied; for the second stress amplitude coefficient given, the frequencies were 0.0033 Hz, 21.8 Hz, 31 and 37 Hz. In both cases it was found that the vibrational creep curves were the higher, in relation to the static creep curve, the lower the applied frequency. GRA

N72-18565# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. REFRACTORY METALS
D. J. Maykuth and E. S. Bartlet 1 Oct. 1971 3 p refs
(AD-731531) Avail: NTIS CSCL 11/6

Contents: Tantalum; Tungsten; Molybdenum; Chromium; Interstitial sink effects. GRA

N72-18566# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. ALUMINUM AND MAGNESIUM
D. N. Williams 29 Sep. 1971 6 p refs
(AD-731528) Avail: NTIS CSCL 11/6

Contents: High strength powder-metallurgy alloys; Further development of X7050 alloy; Fracture toughness of Al-Zn-Mg-Cu alloys; Stress-corrosion-fatigue of high-strength aluminum alloys; Resistivity of aluminum alloys at low temperatures; Improving the properties of 7079 alloy; Fatigue properties of KO-1 castings; Effect of prolonged elevated temperature exposure on the fatigue properties of two aluminum alloys; Magnesium casting alloy ZE63A; Electroplating magnesium alloys. GRA

N72-18567# Air Force Systems Command, Wright-Patterson AFB, Ohio.
A REVIEW OF SOME EXPERIMENTAL PROBLEMS IN STUDYING THERMODYNAMIC BEHAVIOR OF ALLOYS Final Report, Jul. 1969 - Jun. 1970
Edmund J. Rolinski Jul. 1971 57 p refs
(AF Proj. 7360)
(AD-731536; AFML-TR-71-85) Avail: NTIS CSCL 11/6

A brief review of the theoretical aspects underlying the use of the mass spectrometer for studying the thermochemical behavior of alloys is presented. Various considerations of the problem are mentioned and discussed with special emphasis on titanium alloys. These include the use of various methods for measuring the activity or free energy change. For the mass spectrometer to be utilized efficiently for studies on alloys, some ratio method is usually used directly or modified. Various modifications of the ratio method are discussed, both for binary and ternary alloy systems. Author (GRA)

N72-18568# Midwest Research Inst., Kansas City, Mo.
FINE SUBGRAIN STRUCTURE ADJACENT TO FATIGUE CRACKS Technical Report, 1 Apr. - 15 Aug. 1971
J. C. Grosskreutz and G. G. Shaw Wright-Patterson AFB, Ohio AFML Oct. 1971 23 p refs
(Contract F33615-17-C-1379; AF Proj. 7353)
(AD-733719; AFML-TR-71-211) Avail: NTIS CSCL 11/6

Deformation microstructures adjacent to fatigue cracks in 2024-T4 and 7075-T6 aluminum, and Ti-6 Al-4V alloys have been examined by transmission electron microscopy. The data show that material within 1-2 micrometer of a tensile-mode crack consists of very fine (0.1 micrometer) subgrains in all three materials. The average misorientation between the subgrains is 2-4 degrees. The presence of this substructure, which seems to be independent of initial metallurgical condition, is used to explain the weak dependence of Stage 2 crack growth rates on the initial condotion in high stacking fault energy materials. No evidence of precipitate reversion was observed adjacent to the fatigue cracks in 7075-T6 aluminum. Author (GRA)

N72-18569# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. BERYLLIUM
A. N. Ashurst and S. H. Gelles 22 Oct. 1971 5 p refs
(AD-731529) Avail: NTIS CSCL 11/6

Contents: Properties of KBI brake grade beryllium; Properties of plasma consolidated beryllium; Effect of subgrain size on the properties of beryllium sheet; Effect of silicon on the powder metallurgy of beryllium; Deformation mechanism; Diffusion welding; Beryllium plating; Electrochemical machining; Beryllium-titanium composites. GRA

N72-18570# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. NICKLE AND COMBALT-BASE ALLOYS
D. C. Drennen 8 Oct. 1971 5 p refs
(AD-731530) Avail: NTIS CSCL 11/6

Contents: Contour rolling of Rene 95 disks; Development of processing methods for superalloy sheet; Aluminide slurry coatings; Oxidation resistant claddings on IN-100; Effects of electric fields on oxidation and hot corrosion; Oxidation of nickel-aluminum alloys; Oxidation and hot corrosion of dispersed-phase alloys; Edge-notch sensitivity of waspaloy. GRA

N72-18571# Carnegie-Mellon Univ., Pittsburgh, Pa.
DUCTILE FRACTURE AND THE PLASTICITY OF POROUS METALS
Jonathan M. Rosenberg 1 Nov. 1971 23 p refs
(Contract N00014-67-A-0314-004)
(AD-734001) Avail: NTIS CSCL 11/6

It has recently been suggested that since ductile fracture is often the end-product of void growth and coalescence, an understanding of the plastic behavior of porous metals would be of use in studying ductile fracture. A plasticity theory for porous materials would also be of value in predicting the mechanical properties of sintered powder products. Possible forms for such a theory are discussed, and an approximate theory suggested by Kuhn is further analyzed. A few applications are made to fracture mechanics. Author (GRA)

N72-18572# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE EFFECT OF THE STRESS LEVEL AND THE STRESS AMPLITUDE COEFFICIENT ON THE PROCESS OF VIBRATIONAL CREEP
5 Oct. 1971 37 p refs Transl. into ENGLISH from Mech. Teoretyczna i Stosowana (Poland), v. 7, no. 4, 1969 p 485-505
(Contract F33657-71-D-0057; AF Proj. 6010)
(AD-733894; FTD-HC-23-825-71) Avail: NTIS CSCL 11/6

The investigations were carried out on an aluminum alloy A1-Mg-Si (PA4) under an uniaxial state of stress at a temperature of 296 degrees K and a frequency of 31Hz. For a constant mean given stress, the vibrational creep curves are higher in respect to the creep curve, the greater the given stress amplitude coefficient. For a constant maximum given stress, the vibrational creep curves are lower, the greater the given stress. However, for a very small given stress the vibrational creep curve is higher than the creep curve. Thus the strongly activating influence of small vibrations on the vibrational creep process is clearly visible. In the case of a small given stress, it was found that the higher the level of stress, the greater is the effect of the vibrations on the vibrational creep process. A physical interpretation of vibrational creep is also presented in the paper. Author (GRA)

N72-18573# Army Electronics Command, Fort Monmouth, N.J.
CORROSION OF ELECTRONIC COMPONENTS BY FUMES FROM PLASTICS
S. J. Krumbein and A. J. Raffalovich Sep. 1971 27 p
(Dant-Proj. H-66205-A-057)
(AD-733903; ECOM-3468) Avail: NTIS CSCL 11/6

Stressed, clean beryllium copper wires were subject to fumes of selected plastics and fluxes under both humid (70C, 100% RH) and dry (70C) environments. Macro-visual and microscopic examinations as well as resistance value changes were noted. Polyvinyl chloride, one-component RTV silicone rubber, and a stock flux obtained from USAECOM supply were found to be extremely corrosive. The other materials evaluated were rated non-corrosive. Author (GRA)

18 MATERIALS, NONMETALLIC

Includes corrosion; physical and mechanical properties of materials (e.g., plastics); and elastomers, hydraulic fluids, etc. For basic research see: 06 Chemistry. For related information see also: 17 Materials, Metallic; 27 Propellants; and 32 Structural Mechanics.

N72-18574*# Oak Ridge National Lab., Tenn. Metals and Ceramics Div.
ROOM TEMPERATURE MEASUREMENTS OF ELECTRICAL RESISTIVITY AND THERMAL CONDUCTIVITY OF VARIOUS GRAPHITES
D. L. McElroy, T. G. Kollie, W. M. Ewing, R. S. Craves, and R. M. Steele Jul. 1971 12 p refs
(Contract W-7405-eng-26; NASA Order L-58508)
(ORNL-TM-3477; NASA-CR-125652) Avail: NTIS CSCL 11D

Room temperature thermal conductivity measurements were completed on 10 graphite samples selected from the lot of 120 to uniformly span the range of electrical resistivity values. From these data and other measurements a thermal conductivity-electrical conductivity correlation was established to predict room temperature thermal conductivity values for the graphite samples. The correlation, expressed by a parabolic equation, represents available thermal and electrical conductivity data to about + or - 8%. Author

N72-18575# Technische Hochschule Carolo Wilhelmina, Brunswick (West Germany). Naturwissenschaftlichen Fakultaet.
STUDIES ON BISMUTH MANGANESE LAYERS: STRUCTURES, MAGNETIC PROPERTIES, AND MAGNETO-OPTICAL STORAGE Ph.D. Thesis [UNTERSUCHUNGEN AN MNBI-SCHICHTEN: STRUKTUR, MAGNETISCHE EIGENSCHAFTEN UND MAGNETOOPTISCHES SPEICHERN]
Willibald Karl Unger 1971 135 p refs In GERMAN
Avail: NTIS

The crystalline structure and magnetic properties of vapor deposited manganese bismuth layers are studied by magneto-optical, resistance, and electron microscopic methods. It is shown that deposition temperature, annealing, bismuth-mangenese thickness ratios of the layers effect their crystalline structure. Also considered is the utilization of manganese bismuth layers as magneto-optical storage devices. Transl. by G.G.

N72-18576*# IIT Research Inst., Chicago, Ill.
INVESTIGATION OF ENVIRONMENTAL EFFECTS ON COATINGS FOR THERMAL CONTROL OF LARGE SPACE VEHICLES Final Report, 20 May 1963 - 8 Oct. 1971
G. A. Zerlaunt, J. E. Gilligan, and N. A. Ashford 8 Oct. 1971 377 p refs
(Contract NAS8-5379; IITRI Proj. U6002)
(NASA-CR-123531; IITRI-U6002-97) Avail: NTIS CSCL 11C

The objective of significantly advancing the state-of-the-art of white, spacecraft-radiator coatings has been realized in a comprehensive goal-oriented, pigmented-coatings research program. Considered were inorganic pigments and coatings, silicone polymers and coatings, the design and construction of a combined ultraviolet-plus-proton irradiation facility, the development of zinc orthotitanate pigment and coatings, and the effects on several low alpha sub s/epsilon paints of combined ultraviolet and proton irradiation. Author

N72-18577*# Hercules, Inc., Magna, Utah. Bacchus Works
DEVELOPMENT OF LIGHTWEIGHT GRAPHITE/POLYIMIDE HONEYCOMB. PHASE 1: MATERIALS SELECTION
J. G. Poesch Jul. 1971 42 p refs
(Contract NAS9-11368)
(NASA-CR-115421; H400-12-1-8) Avail: NTIS CSCL 11D

The materials selected for the production of extremely lightweight honeycomb sandwich panels are discussed. The resin selected for the first core and face sheet fabrication was Monsanto RS6234 polyimide. The fiber selected for core manufacture was Hercules HT-S, and for face sheets, Hercules HM-S; these selections are discussed. Author

N72-18578*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
COATINGS FOR AIRCRAFT GAS TURBINE ENGINES AND SPACE SHUTTLE HEAT SHIELDS: A REVIEW OF LEWIS RESEARCH CENTER PROGRAMS
Salvatore J. Grisaffe and John P. Merutka 1 Feb. 1972 7 p refs Presented at 19th Refractory Composite Working Group, Houston, Tex., 1-2 Feb. 1972; sponsored jointly by NASA and AFML
(NASA-TM-X-68007) Avail: NTIS CSCL 11C

The status of several coating programs is reviewed. These include efforts on protecting aircraft gas turbine engine materials from oxidation/corrosion and on protecting refractory metal reentry heat shields from oxidation. Author

N72-18579*# Solar, San Diego, Calif.

EVALUATION OF COATINGS FOR COBALT- AND NICKEL-BASE SUPERALLOYS, VOLUME 2 Final Report

V. S. Moore, W. D. Brentnall, and A. R. Stetson Jul. 1970 172 p refs
(Contract NAS3-9401)
(NASA-CR-72714; RDR-1474-3) Avail: NTIS CSCL 11C

The final results of an oxidation-reduction rig evaluation of aluminide coatings are presented, as applied to 1N-100 and B1900 nickel-base and X-10 and WI-52 cobalt-base alloys. Burner rigs were used which operated on JP-5 fuel and air, producing a gas velocity of 0.85 (2000 to 2500 ft/sec) at the specimen's leading edge. One-hour heating cycles were used with three minutes of air blast cooling. Results of testing at temperatures ranging from T sub max of 1850 to 2050 F indicate that coated B1900 has the longest oxidation life at all temperatures, followed by IN-100>X-40>WI-52, based on a weight change criterion. Coatings on nickel-base alloys provided more than twice the life of coating on cobalt-base alloys at comparable temperatures. The coatings with higher aluminum content and comparable thickness had longer lives. Silicon appeared to be a beneficial additive in the nickel-base alloy coatings for long term, low temperature life, but not for short term, high temperature performance. Chromium was identified in all coatings. Extrapolating the life results obtained to 1600 F, all the selected coatings on the four alloys would be protective for at least 10,000 hours. Author

N72-18580+ Institut zur Erforschung Technologischer Entwicklungslinien, Hamburg (West Germany).

DEVELOPMENT AND APPLICATION POSSIBILITIES OF FIBER REINFORCED COMPOSITES [FASERVERSTAERKTE VERBUNDWERKSTOFFE ENTWICKLUNGS- UND EINSATZMOEGLICHKEITEN]

Rainer Taprogge 1971 15 p refs In GERMAN
(ITE-2/1971) Copyright. Avail: NTIS

The utilization of fiber reinforced composites as construction materials depends on their mechanical and thermal stability properties. Especially suitable are polyimides, polybenzimidazoles, and polybenzothiazoles that resist briefly temperatures up to 500 C, and for longer periods of time temperatures up to about 400 C. Newly developed inorganic polymers even resist temperatures up to 1000 C; however, the brittleness problem is pronounced. Also considered are production costs and the degree of difficulty in composite fabrication processes in relation to their effective applications. Transl. by G.G.

N72-18581*# Astro Research Corp., Santa Barbara, Calif.

IMPROVED OXIDATION-RESISTANT CARBON AND GRAPHITE MATERIALS

Hugh M. Muir Washington NASA Mar. 1972 18 p refs
(Contract NAS7-728)
(NASA-CR-1970; ARC-R-411) Avail: NTIS CSCL 11D

A variety of silicon-carbide treated carbon and graphite products were prepared, and oxidation and strength properties determined. Carbon and graphite materials used in the preliminary study include fiber, tape, felt, foam, bulk, and laminar configurations. The silicon-carbide treatment used in preparing the oxidation resistant specimens employs either vacuum or ultrasonic impregnation of various silicone-silicon mixtures into the matrix material. The impregnation phase is followed by controlled thermal reaction at which time the silicon carbide is synthesized and takes the form of an integral protective boundary layer. Thickness of the layer ranges from a fraction of a mil to 10 mils, depending on the matrix material and processing parameters. Oxidation resistance of all the silicon-carbide-treated specimens investigated was found to be significantly improved. Mechanical strengths of the laminar composites were also found to be somewhat improved. At room temperature the specific strength of the silicon-carbide treated fibers and tapes was degraded to some extent; however, their relative strengths were significantly increased at elevated temperatures in oxidizing atmosphere. Author

N72-18582*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN PROPERTIES OF RANDOMLY REINFORCED FIBER COMPOSITES

Christos Chamis Washington Mar. 1972 25 p refs
(NASA-TN-D-6696; E-6569) Avail: NTIS CSCL 11D

The pseudoisotropic-laminate analogy is used in conjunction with fiber composite micro- and macromechanics to predict the thermal and mechanical properties of planar randomly reinforced fiber composites (PRRFC). Theoretical results are presented for boron/aluminum, boron/epoxy, Thornel-50/epoxy, and S-glass/epoxy PRRFC. The results show that the thermal and elastic properties depend on both constituent materials and the fiber volume ratio. The strength depends also on the type of applied stress. In general, no simple ratio exists between the properties of unidirectional fiber composites and those of PRRFC. The data are presented in convenient graphical form to serve as an aid for design and/or analysis and also for further research in PRRFC. The residual stresses and the impact resistance are also theoretically examined. Author

N72-18583*# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Mechanical Engineering.

INTERACTIVE PROGRAM FOR ANALYSIS AND DESIGN PROBLEMS IN ADVANCED COMPOSITES TECHNOLOGY Final Report, Nov. 1969 - Oct. 1971

T. A. Cruse and J. L. Swedlow Dec. 1971 296 p refs
(Grant NGR-39-002-023; Contract F33615-70-C-1146; AF Proj. 6169-CW)
(NASA-CR-125596; AFML-TR-71-268) Avail: NTIS CSCL 11D

During the past year an experimental program in the fracture of advanced fiber composites has been completed. The experimental program has given direction to additional experimental and theoretical work. A synthesis program for designing low weight multifastener joints in composites is proposed, based on extensive analytical background. A number of failed joints have been thoroughly analyzed to evaluate the failure hypothesis used in the synthesis procedure. Finally, a new solution is reported for isotropic and anisotropic laminates using the boundary-integral method. The solution method offers significant savings of computer core and time for important problems. Author

N72-18584*# TRW Systems Group, Redondo Beach, Calif.

THERMALLY STABLE LAMINATING RESINS

R. J. Jones, R. W. Vaughan, and E. A. Burns 7 Feb. 1972 201 p refs
(Contract NAS3-13489)
(NASA-CR-72984; TRW-16402-6012-R0-00) Avail: NTIS CSCL 11I

Improved thermally stable laminating resins were developed based on the addition-type pyrolytic polymerization. Detailed monomer and polymer synthesis and characterization studies identified formulations which facilitate press molding processing and autoclave fabrication of glass and graphite fiber reinforced composites. A specific resin formulation, termed P10P was utilized to prepare a Courtaulds HMS reinforced simulated airfoil demonstration part by an autoclave molding process. Author

N72-18585*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DEVELOPMENT OF DISPERSION-STRENGTHENED Ni-Cr-ThOZ ALLOYS FOR THE SPACE SHUTTLE THERMAL PROTECTION SYSTEM

Charles P. Blankenship and Neal T. Saunders 1972 33 p refs
Presented at Western Metal and Tool Expo, Los Angeles, 13-17

Mar. 1972; sponsored by Am. Soc. for Metals and Soc. of Manufacturing Eng.
(NASA-TM-X-68024; E-6830) Avail: NTIS CSCL 11D

Manufacturing processes were developed for TD-NiCr providing small sheet (45 x 90 cm), and larger sheet (60 x 150 cm) and foil. The alternate alloy, DS-NiCr, was produced by pack-chromizing Ni-ThO_2 sheet. Formability criteria are being established for basic sheet forming processes, which are brake forming, corrugation forming, joggling, dimpling, and beading. Resistance spot welding (fusion and solid state), resistance seam welding, solid state diffusion welding, and brazing are included in the joining programs. Major emphasis is centered on an Al-modified Ni-Cr-ThO_2 alloy development. These alloys, containing 3 to 5% Al, form the protective Al_2O_3 scale. This enhances oxidation resistance under reentry conditions. Both TD-NiCrAl and DS-NiCrAl alloys are included. A tentative composition of Ni-16Cr-3.5Al-2ThO_2 was selected based on oxidation resistance and fabricability. Author

N72-18586# Sanders Nuclear Corp., Nashua, N.H.
THULIUM OXIDE FOR THERMAL SOURCE APPLICATIONS. PART 1: MATERIALS PROPERTIES MEASUREMENTS. PART 2: ENVIRONMENTAL BEHAVIOR AND MECHANICAL, THERMAL AND CHEMICAL STABILITY ENHANCEMENT
C. A. Nelson, R. W. Anderson, C. R. Fink, A. Tse, and W. J. Fretague 1970 248 p refs
(Contract AT(40-1)-3693)
(SNC-3693-2) Avail: NTIS

The feasibility of encapsulated thulium-170 oxide for use as an isotopic fuel was studied. This radioisotope provides a readily produced thermal energy source for operation at temperatures through 1500 C for missions through 180 days. Phase diagram determination, compatibility, capsule parametric design, and radiation shielding are included. The results show conclusively that thulium-170 sesquioxide can be successfully applied as an encapsulated isotopic fuel. A basic procedure for preparing Tm_2O_3/Yb_2O_3 composites was experimentally evaluated, and a modified procedure was used to prepare test coupons. Melting points and solid-state transformations to the melting point of a composition series 100% Tm_2O_3-Yb_2O_3 were determined. Solid-state reaction of candidate containment materials (Hastelloy X, Hastelloy C-276, Haynes-25, T-111, TZM, tungsten, and zirconium) with Tm_2O_3/Yb_2O_3 were studied. Author (NSA)

N72-18587# Maryland Univ., College Park. Dept. of Chemistry.
POLYMERIC SYSTEMS WHICH EXPAND ON POLYMERIZATION FOR USE IN HIGH STRENGTH COMPOSITES Annual Progress Report, 1 Feb. 1970 - 31 Jan. 1971
William J. Bailey 1 Aug. 1971 53 p refs
(Contract N00019-70-C-0240)
(AD-733697) Avail: NTIS CSCL 11/9

Among the monomers that give some expansion on polymerization is the spiro ortho ester, 1,4,6-trioxaspiro(4,4)-nonane. When polymerization of this monomer was carried out in a dilatometer at 25 deg., the meniscus rose during the polymerization to give a final expansion at 95% conversion of 0.14%. The polymer, which had the expected analysis and spectra, has a molecular weight of about 25,000. Thus, the principle that bicyclic monomers can be prepared that will polymerize with expansion has been clearly demonstrated. Author (GRA)

N72-18588# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
SELF-LUBRICATING COMPOSITE MATERIALS FOR NAVAL AIRCRAFT. DIFFERENTIAL THERMAL ANALYSIS OF SELF-LUBRICATING BEARING SYSTEM COMPOSITIONS AND WEAR DEBRIS Progress Report
Alfeo A. Conte, Jr. 28 Jun. 1971 25 p refs
(AD-732761; NADC-MA-7138) Avail: NTIS CSCL 13/9

Differential Thermal Analysis (DTA) was employed as an analytical device in the study of physical and chemical changes associated with high bearing contact area temperatures for self-lubricating Mo-S-Fe and W-S-Fe bearing systems, which were investigated using Falex lubricant equipment. Initial reaction temperatures for the elemental constituents comprising these systems were determined. Wear debris from those self-lubricating systems, which exhibited extended endurance life, was analyzed using the DTA technique. Free energy considerations, together with thermoanalytical results and wet chemical tests, suggest that compound formation, i.e., MoS_2 and WS_2, is a key factor in achieving extended performance life for these systems. Author (GRA)

N72-18589# Army Missile Command, Redstone Arsenal, Ala.
A STUDY OF SOME PARAMETERS AFFECTING FILM BOILING DEPOSITION
Vernon A. Nieberlein Jul. 1971 23 p refs
(DA Proj. 1T0-62105-A-331)
(AD-733304; RR-TR-71-9) Avail: NTIS CSCL 11/5

A continuation of laboratory work on a process for depositing SiC by film boiling is described. The effects of time and fiber diameter on plating rates were determined empirically. Variations in plating cell geometry, intermediate contacts, and pre-plating treatments on the tungsten substrate were investigated. Eleven additives to the plating fluid were tried and their effects on the quality of the deposit were noted. Author (GRA)

N72-18590# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A THERMAL COMPARATOR FOR NONDESTRUCTIVELY EXAMINING FIBER COMPONENTS Final Technical Report
J. I. Craig, S. Smith, and W. H. Horton Fort Eustis, Va. Army Air Mobility Res. and Develop. Lab. Sep. 1971 55 p
(Contract DA-44-177-AMC-115(T))
(AD-733373; SUDARR-319; USAAVLABS-TR-69-2723) Avail: NTIS CSCL 11/4

A novel device for the nondestructive testing of fiber composites is discussed. It is basically a comparator designed to detect nonconformities in the thermal properties of the material studied. Principal advantages of the instrument are its simplicity of design and operation and its very modest cost. A series of test results for metallic and nonmetallic inclusion detection is presented. The applicability to thickness determinations is examined, and several promising users of the device are suggested. Author (GRA)

N72-18591# Midwest Research Inst., Kansas City, Mo.
VAPORIZATION KINETICS AND THERMODYNAMICS OF GRAPHITE USING THE HIGH PRESSURE MASS SPECTROMETER Technical Management Report, 1 Jun. - 31 Aug. 1971
Thomas A. Milne, Jacob E. Beachey, and Frank T. Greene 14 Oct. 1971 17 p refs
(Contract F33615-71-C-1577; AF Proj. 7360)
(AD-733562; TMR-1) Avail: NTIS CSCL 11/2

Carbon vaporization studies are continuing under a new contract. In preparation for mass spectral studies extending well beyond 3000 K, the original, high sensitivity, single electron beam aperture ion source has been reinstalled and found to be at least temporarily adequate for normal mass spectrometry of modulated beams. Its time response is still not suitable for time-of-flight velocity analysis. Induction heating tests of various all graphite, shielded, Knudsen cells have been carried out in one atmosphere argon in a very simple arrangement that permits rapid interchange of parts and easy visual observations of heating behavior. Using a recently acquired, automatic, recording, photoelectric pyrometer, an optimized cell has been heated in vacuum and species $C_1(-)$,...,$C_7(-)$ measured at temperatures up to 3300 K. A Ti(-) impurity obscures $C_4(-)$ measurements early in the heating history of present cells. Author (GRA)

N72-18592# National Bureau of Standards, Washington, D.C. Inorganic Materials Div.
ARPA-NBS PROGRAM OF RESEARCH ON HIGH

TEMPERATURE MATERIALS AND LASER MATERIALS Technical Note, 1 Jan. - 30 Jun. 1971
A. D. Franklin and H. S. Bennett Dec. 1971 43 p refs
(ARPA Order 373-62)
(AD-733511; NBS-TN-703) Avail: NTIS CSCL 11/2

Progress reports are given for projects on the growth of ultra-pure Al2O3 crystals, the development of a mass spectrometer-based sectioning technique for measuring oxygen diffusion in oxides and the development of a precision facility for measuring the threshold energy in a laser beam producing damage in a transparent substance. Author (GRA)

N72-18593# University of South Florida, Tampa.
MECHANICS OF COMPOSITE MATERIALS Final Report, 26 Oct. 1966 - 30 Jun. 1970
John E. Griffith, Bernard E. Ross, and Robert W. Ellis, Jr. 12 Nov. 1971 9 p
(Contract DAHC04-67-C-1069)
(AD-733484; AROD-6378-3-E) Avail: NTIS CSCL 11/4

The primary objective of the program was the determination of the stress and strain fields in those local regions adjacent to the particulate fillers in matrix composites. Not only is the general mechanical behavior best understood on this microstructural level, but subsequent attainment of critical values of stresses and strains can be incorporated in an appropriate condition of failure. Author (GRA)

N72-18594# Army Missile Command, Redstone Arsenal, Ala.
EFFECT OF PLASTICIZERS ON THE STRENGTH OF A PLASTIC MOTOR CASE Final Report
Donald A. Morgan Oct. 1971 23 p refs
(DA Proj. 1M2-62303-A-214)
(AD-733363; RK-TR-71-18) Avail: NTIS CSCL 11/9

The report summarizes the effect of plasticizers on the strength of a glass-fiber-reinforced plastic motor case and, specifically, the effect on the burst strength of the motor case. Maximum average loss in burst strength occurred with dipropyl adipate and amounted to 79 psi out of an average burst of the blank of 2842 psi. Deterioration did not increase with longer intervals of storage. A direct correlation could be established between burst pressure and extension at break of a ring cut from an identical (same lot) motor case and treated with plasticizer. In addition, a direct correlation could be established between burst pressure and the reciprocal of the amount of sag of a coupon cut from an identical motor case. The effect on a motor case after two years storage in contact with a plasticizer is considered negligible. Author (GRA)

N72-18595# Army Foreign Science and Technology Center, Charlottesville, Va.
CHANGE IN STRENGTH PROPERTIES OF POLYCARBONATE UNDER THE INFLUENCE OF A POWERFUL LIGHT BEAM
N. N. Vsevolodov and G. P. Itinskaya 20 Oct. 1971 10 p refs Transl. into ENGLISH from Mekhan. Polimerov, Akad. Nauk Latv. SSR (Riga), no. 2, 1968 p 288-292
(FSTC Proj. T7023012301)
(AD-733765; FSTC-HT-23-1187-71) Avail: NTIS CSCL 11/9

It has been demonstrated in that a large number of microcracks covered with carbon black are formed within polycarbonate (PC) when it is struck by a powerful light flux. These microformations should probably have a definite influence on the strength properties of a polymer specimen. This work is dedicated to the study of this influence. Author (GRA)

N72-18596# IIT Research Inst., Chicago, Ill.
PROPERTIES OF RE-ENTRY MATERIALS Final Technical Report, Apr. 1969 - Jun. 1971
Seymour A. Bortz Wright-Patterson AFB, Ohio AFML Oct. 1971 226 p refs
(Contract F33615-69-C-1454; AF Proj. 7381; IITRI Proj. G6030)
(AD-733731; IITRI-G6030-FR; AFML-TR-71-198) Avail: NTIS CSCL 11/4

The work performed on this program consisted of the generation of engineering data for REST 6300, a two dimensionally reinforced molded carbon phenolic composite, the determination of the elevated temperature properties of FEP Teflon, and the preliminary flexure and compression testing of a pierced fabric composite. The REST 6300 was pre-charred before testing to eliminate char variations during testing. Four zones of material were investigated: virgin material, zone 3 char which was heat treated to 1200F, zone 2 char which was heat treated to 2500F, and zone 1 char which was heat treated to 4000F. Each of the four zones was fully characterized for density, composition using powder X-ray analysis, and for microstructure using the light microscope and the scanning electron microscope. Author (GRA)

N72-18597# Aerospace Corp., El Segundo, Calif. Systems Engineering Operations.
THERMAL EXPANSION BEHAVIOR OF A THERMALLY DEGRADING ORGANIC MATRIX COMPOSITE. SIMPLE DEGRADATION OF MATRIX, JUNE - SEPTEMBER 1969
James D. Buch 7 Dec. 1971 31 p refs
(Contract F04701-71-C-0172)
(AD-733726; TR-0172(2115)-1; SAMSO-TR-71-234) Avail: NTIS CSCL 11/4

The thermal expansion behavior of a material undergoing a one-stage chemical degradation with accompanying shrinkage is discussed. It is shown that once the material parameters associated with the reaction kinetics are specified, the thermal expansion behavior, at arbitrary heating rates, can be determined. An example is given of a heated halfspace, and significant departures from expansion values obtained at uniform heating rates are noted. Author (GRA)

N72-18598# Battelle Memorial Inst., Columbus, Ohio. Defense Metals Information Center.
REVIEW OF RECENT DEVELOPMENTS. OXIDATION-RESISTANT COATINGS FOR REFRACTORY METALS
B. C. Allen 17 Nov. 1971 4 p refs
(AD-733835) Avail: NTIS CSCL 11/3

Contents: Oxidation-resistant coatings for refractory metals; Evaluation of coated columbium and tantalum alloys for space shuttle applications; Oxidation of coated unalloyed columbium; Tungsten-silicon-oxygen interactions. GRA

N72-18599# Army Foreign Science and Technology Center, Charlottesville, Va.
STRESS RELAXATION OF RIGID GLASS FIBER-REINFORCED PLASTICS
I. I. Muralis, Ya. P. Baushis, and G. N. Finogenov 26 Aug. 1971 10 p refs Transl. into ENGLISH from Litov. Mekhan., Sb. (USSR), no. 2(3), 1968 p 129-135
(AD-733778; FSTC-HT-23-508-71) Avail: NTIS CSCL 11/9

The purpose of the work was to analyze the strength of glass fiber-reinforced plastics under conditions of stress relaxation. Stress relaxation was analyzed in glass fiber-reinforced plastics with oriented and fabric glass fiber under uniaxial tension at room temperature and at elevated temperatures. Author (GRA)

N72-18600# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
PROBLEM OF HEAT-RESISTANT COATINGS IN MODERN TECHNOLGY
V. E. Ivanov 27 Sep. 1971 11 p refs Transl. into ENGLISH from the publ. "Vysokotemperaturnyye Pokrytiya. Trudy Seminarapo Zharostoykim Pokrytiyam, Leningrad, 26-28 May 1965" Moscow, Nauka, 1967 p 3-4
(AD-733865; FTD-MT-24-975-71) Avail: NTIS CSCL 11/3

Data is given which shows that all nickel coatings in one or another degree increases the short term heat resistance of steels in the temperature interval of 650-850C. With an increase in the thickness of the coating, the porosity of the deposits is reduced, which leads to an increase in the resistance of the steel to oxidation. The best protection of steel from oxidation during enameling can be guaranteed by a nickel phosphorous coating which at 850C has the greatest heat resistance. Author (GRA)

N72-18601# Defense Documentation Center, Alexandria, Va.
BORON IN COMPOSITE MATERIALS Report Bibliography, Aug. 1961 - Apr. 1971
Nov. 1971 90 p refs
(AD-733870; DDC-TAS-71-52-1) Avail: NTIS CSCL 11/4

The references in the bibliography deal with the use of Boron, and Boron fibers in prolonging the life and reinforcing the structure of composite materials. The resistivity, elasticity, and thermal properties of these composites are discussed. There is also a cross section of references on the manufacturing methods and tests. Author (GRA)

N72-18602# Naval Air Development Center, Johnsville, Pa. Aero Materials Dept.
THE DEVELOPMENT OF IMPROVED ALUMINUM POLISHES FOR NAVAL AIRCRAFT, PART 2 Final Report
W. E. MacKenzie and P. N. Bellavin 28 Sep. 1971 20 p ref
(AD-733403; NADC-MA-7163) Avail: NTIS CSCL 11/11

A final report is made on the development of polishes and corrosion removers for use on bare aluminum surfaces of naval aircraft. Typical formulations and specification requirements are given. Author (GRA)

N72-18603# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HIGH VOLTAGE INSULATION OF LINES AND EQUIPMENT (SELECTED ARTICLES)
M. K. Kalinina 22 Sep. 1971 127 p refs Transl. into ENGLISH from Politekhn. Inst., Tr. (Leningrad), no. 258, 1965 p 3-9, 61-78, 88-105, 116-117, 132-137, and 161-171
(AD-734055; FTD-HC-23-749-71) Avail: NTIS CSCL 11/7

Contents: Generator of 2.2 MV voltage pulses; Method of comparative research when determining the equivalence of synthetic schemes for testing high-voltage switches; The quenching of an electric arc in elegas; The study of the characteristics of a metal arc-quenching chamber of an air switch; Spontaneous operation of controlled spark gaps; A statistical method of determining the time scatter of discharges in controlled spark gaps; A reduction of the spread of breakdown voltages in breakdown tests liquid dielectrics; The value of the coefficient of dielectric ansorption for electric condensers of various types; Ionization characteristics of polymerized insulation. GRA

N72-18604# Physics Technology Labs., Inc., La Mesa, Calif.
INVESTIGATION OF COATING PLASTIC LENSES WITH SPUTTER-DEPOSITION PROCESS Final Report, 14 Jan. 1970 - 1 Jun. 1971
Ben B. Meckel and Patrick A. Harkins 1 Jun. 1971 32 p refs
(Contract DAAA15-70-C-0269)
(AD-733943; A-0094) Avail: NTIS CSCL 11/3

Coatings from 500 to 10,000 A thick of SiO_2 and Al_2O_3 were deposited on polycarbonate lenses. Techniques were established for depositing transparent, glass-like coatings without introducing changes in the visual properties of the lenses. One result of the program was the discovery that the present 'mar resistance' test is not applicable to testing of optical coatings. The technical objectives of the effort were met with the exception of an anticipated parametric study. In the final stages of the investigation, effort was applied to the preliminary design for mass production equipment. The results of this investigation provide sufficient information to enable the prediction of production rates. Author (GRA)

N72-18483# Michigan Univ., Ann Arbor.
RUBBER STRUCTURE AND PROPERTIES
S. D. Gehman *In its* Mech. of Pneumatic Tires Nov. 1971 p 1-40 refs (See N72-18482 09-15)
Avail: Sod $4.75 as C13.44:122

N72-18484# Michigan Univ., Ann Arbor. Dept. of Mechanical Engineering.
FRICTION OF RUBBER
K. C. Ludema *In its* Mech. of Pneumatic Tires Nov. 1971 p 41-62 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

N72-18487# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
PROPERTIES OF CORD-RUBBER LAMINATES
Samuel K. Clark *In its* Mech. of Pneumatic Tires Nov. 1971 p 307-353 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

N72-18605# Louvain Univ. (Belgium). Inst. de Mathematique Pure et Appliquee.
GENERAL STABILITY FOR ORDINARY DIFFERENTIAL EQUATIONS [STABILITE D'ENSEMBLES POUR DES EQUATIONS DIFFERENTIELLES ORDINAIRES]
Dang-Chau Phien and Nicolas Rouche Sep. 1970 22 p refs In FRENCH
(Rept-37) Avail: NTIS

The stability of closed groups is considered. Definitions are presented and the situation of a mobile point with respect to a group is discussed. Localization of a solution and sufficient conditions for stability are also considered. Asymptotic stability is treated. Transl. by K.P.D.

N72-18606# Academy of Sciences (USSR), Moscow.
QUANITIZATION OF A NONLINEAR RELATIVISTIC FIELD WITHOUT USING PERTURBATION THEORY
Yu. A. Rylov 1971 60 p refs In RUSSIAN; ENGLISH summary
(PR-68) Avail: NTIS

A method for quantizing a nonlinear relativistic field is suggested, based on the separation of the concepts of energy and the Hamiltonian. The method allows one to consider a vacuum as a stationary state, with zero eigenvalues for energy, momentum, and other physical parameters. Exact solutions may be obtained without using perturbation theory. If infinite integrals do appear, they are in the denominator and do not lead to any difficulties. An application of the method is demonstrated in the example of a nontrivial relativistic model in two-, three-, and four-dimensional space-time. The commutation relations for different times, the mass spectrum, and the S-matrix are obtained. Only exact solutions are used. Author

N72-18607*# Behavioral Technology Consultants, Silver Spring, Md.
STATISTICAL ASSESSMENT OF A UNIQUE TIME SERIES ANALYSIS TECHNIQUE
Vernon A. Benignus Jan. 1972 24 p refs
(Contract NAS9-11784)
(NASA-CR-115399) Avail: NTIS CSCL 12A

Empirical tests of a particular least squares multiple prediction program were studied, as well as the relationship of this particular program to general least squares multiple prediction theory. Empirical evaluation and test of the program involved: (1) conversion of the program to run on an IBM 360/44 with replication of test results obtained on a Univac 1108; and (2) generation and analysis of Monte Carlo simulated data with the objective of comparison against results theoretically obtainable from spectrum analysis routines. Author

N72-18608*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

CONSTRAINED CHEBYSHEV APPROXIMATIONS TO SOME ELEMENTARY FUNCTIONS SUITABLE FOR EVALUATION WITH FLOATING POINT ARITHMETIC

Paul Manos and L. Richard Turner Washington Mar. 1972 70 p refs
(NASA-TN-D-6698; E-6222) Avail: NTIS CSCL 12A

Approximations which can be evaluated with precision using floating-point arithmetic are presented. The particular set of approximations thus far developed are for the function TAN and the functions of USASI FORTRAN excepting SQRT and EXPONENTIATION. These approximations are, furthermore, specialized to particular forms which are especially suited to a computer with a small memory, in that all of the approximations can share one general purpose subroutine for the evaluation of a polynomial in the square of the working argument. Author

N72-18609*# Texas A&M Univ., College Station. Inst. of Statistics.

SEQUENTIAL CONTROL CHART METHODOLOGY

Nov. 1971 30 p refs
(Grant NGR-44-001-095)
(NASA-CR-115439; TR-9) Avail: NTIS CSCL 12A

A modification of the V mask sequential control chart is proposed. In this modified scheme, a parabolic section is included in the mask to provide better performance when the process undergoes a large change in the mean from goal conditions. It is shown that the modified V mask can be implemented either in conventional graphic form, or in an algorithmic form suitable for a digital computer. Average run lengths are given for a typical range of circumstances. It also is shown that the conventional Shewhart chart is better than a sequential chart for the specific purpose of promptly detecting very large shifts of the mean from goal conditions. Author

N72-18610# RAND Corp., Santa Monica, Calif.

TURAN'S THEOREM FOR K-GRAPHS

Joel Spencer Jul. 1971 8 p refs
(AD-732665; P-4648-1) Avail: NTIS CSCL 12/1

Positive integers are denoted. A k-graph with n vertices, q edges, and no independent set of size b is examined. The exact values of T(n, 2, b) were found, and two theorems are also expanded. J.A.M.

N72-18611# Texas A&M Univ., College Station. Inst. of Statistics.

A GOODNESS OF FIT TEST BASED ON THE SPACING OF SELECTED ORDER STATISTICS Technical Progress Report on Themis Optimization Research Program

Dan Lurie and H. O. Hartley Aug. 1971 64 p refs
(Contract N00014-68-A-0140; NR Proj. 047-700)
(AD-733052; THEMIS-TR-32) Avail: NTIS CSCL 12/1

Work on the statistical control of the optima of mathematical functions (statistical solution of non-linear optimization) has led to the statistical problem of estimating the upper limit of a finite range distribution from a random sample of ascent paths. The task of setting confidence limits for this upper limit necessitates the use of a non-parametric goodness of fit criterion. Since the criteria in the literature are not particularly suited to this purpose, it has been necessary to develop suitable criteria ab initio. Specifically, the present report is concerned with the development of a one sample goodness of fit test which is particularly sensitive to tail discrepancies between the true distribution F(x) and the hypothesized distribution F sub O(x) of a continuous variate x. Author (GRA)

N72-18612# Texas A&M Univ., College Station. Inst. of Statistics.

THE OPTIMIZATION OF RESPONSE SURFACE DESIGNS

H. O. Hartley and J. B. Crowell Oct. 1971 98 p refs
(Contract N00014-68-A-0140; NR Proj. 047-700; Proj. Themis)
(AD-733054; THEMIS-TR-34) Avail: NTIS CSCL 12/1

The report applies the techniques of non-convex non-linear programming to the problem of optimizing experimental designs in response surface analysis. Specifically, response surfaces which are quadratic or cubic in the input factors are considered. The region of experimentation is bounded by hyperplanes but specifically hypercubes are considered in the evaluation of optimum designs. The procedure employs the Rosen projected gradient method with a statistical sample of starting points. The objective function employed is the generalized variance of the estimated effect coefficients in the estimated response surface analysis. The report also contains a critical evaluation of this objective function and a comparison with the techniques by Box and Draper which has been successfully used in small scale problems. Author (GRA)

N72-18613# Army Electronics Command, Fort Monmouth, N.J.

A HYBRID COMPUTER TECHNIQUE FOR FEEDBACK CONTROL OPTIMIZATION Research and Development Technical Report

David R. Sharp Sep. 1971 16 p refs
(DA Proj. 1H1-62202-A-219)
(AD-733291; ECOM-3469) Avail: NTIS CSCL 12/1

A direct perturbation optimization technique with second-order convergence is presented that is particularly designed for implementation on a hybrid computer. The method satisfies direct terminal equality and inequality constraints on the state variables and trajectory equality and inequality constraints on the control and state variables. Linear and nonlinear systems with single or multiple inputs can be handled and the terminal time can be fixed or free. The technique appears to be especially useful in the design of suboptimal flight controls for helicopters where some aircraft states are too costly or difficult to measure. Author (GRA)

N72-18614# Illinois Univ., Urbana. Coordinated Science Lab.

OPTIMIZATION AND DECOUPLING OF LARGE DYNAMIC SYSTEMS WITH APPLICATIONS TO POWER SYSTEMS Ph.D. Thesis

Gurdial Singh Sep. 1971 186 p refs
(Contract DAAB07-67-C-0199)
(AD-733898; R-531; UILU-ENG-71-2234) Avail: NTIS CSCL 12/1

The report deals with some theoretical problems of decoupling and optimization of large dynamic systems and the application of some of this theory to the optimization of transient response of a power system. The standard procedures of optimal control theory, although directly applicable in principle to large systems, present many computational complexities when implemented. Even with the use of modern day computers, problems of numerical accuracy, insufficient storage space and too much computation time occur very frequently when systems of high dimensionality are involved. A large system optimization problem can be solved by two possible approaches if none of the standard procedures is numerically adequate. Either new algorithms can be developed which respond to the system size or the system representation can be simplified and an approximate solution attempted. In the latter case the solution accuracy may have to be sacrificed if an appropriate reduction of the system is not found. Author (GRA)

20 METEOROLOGY

Includes climatology; weather forecasting; and visibility studies. For related information see also: 13 Geophysics; and 30 Space Sciences.

N72-18615 National Center for Atmospheric Research, Boulder, Colo.
CLIMATE OF THE UPPER AIR: SOUTHERN HEMISPHERE. VOLUME 2: ZONAL GEOSTROPHIC WINDS
H. VanLoon, J. D. Taljaard (Weather Bureau, Pretoria, South Africa), R. L. Jenne, and H. L. Crutcher (Natl. Climatic Center) May 1971 80 p refs Sponsored in part by the DOD Prepared jointly with the Natl. Climatic Center
(NCAR-TN/STR-57; NAVAIR-50-1C-56) Avail: Issuing Activity

Maps of the mean geostrophic winds are presented, and the method of computation and characteristics of seasonal variations are described. Maps of the mean zonal wind component for the whole hemisphere and associated grid point values are given for January, April, July, and October at sea level, 500, 200, and 100 mb. Cross sections of monthly mean wind components are also given for the same months at longitudes from 10 deg west to 20 deg east at 30 deg intervals. N.E.N

N72-18616 National Center for Atmospheric Research, Boulder, Colo.
CLIMATE OF THE UPPER AIR: SOUTHERN HEMISPHERE. VOLUME 3: VECTOR MEAN GEOSTROPHIC WINDS (ISOGON AND ISOTACH ANALYSES)
R. L. Jenne, H. L. Crutcher (Natl. Climatic Center), H. VanLoon (Weather Bureau, Pretoria, South Africa), and J. J. Taljaard May 1971 122 p refs Sponsored in part by the DOD Prepared jointly with the Natl. Climatic Center
(NCAR-TN/STR-58; NAVAIR-50-1C-57) Avail: Issuing Activity

Isogon and isotach maps of the mean geostrophic winds are presented, and the differences between geostrophic and real winds and reasons for the differences are discussed. The maps give resultant mean geostrophic wind speed and direction and associated grid values for January, April, July, and October at sea level and 850, 700, 500, 300, 200 and 100 mb. N.E.N.

N72-18617# Servicio Meteorologico Nacional, Buenos Aires (Argentina).
FREEZING REGIMEN IN THE CULTIVATED AREAS OF MENDOZA [REGIMEN DE HELADAS EN LA ZONA CULTIVADA DE MENDOZA]
1970 56 p refs In SPANISH
(Rept-7) Avail: NTIS

The topographic nature of the cultivated region of Mendoza in the eastern ranges of the Andes causes a well defined local behavior of minimum temperatures. Measurements made during the springs of 1960, 1961, and 1962 were analyzed. It was found that the local differences in minimum temperatures are so correlated with the mean values that correcting factors can be applied to the minimum temperature forecast for one place to adjust the value for neighboring locations. An estimation of typical error introduced into the final correction factor provides an easy and practical way to ensure frost protection to crops. Author

N72-18618# Servicio Meteorologico Nacional, Buenos Aires (Argentina).
CONTRIBUTION TO THE KNOWLEDGE OF THE EVAPORATION REGIMEN IN THE REPUBLIC OF ARGENTINA [CONTRIBUCION AL CONOCIMIENTO DEL REGIMEN DE EVAPORACION EN LA REPUBLICA ARGENTINA]
Roberto M. Quintela 1970 38 p refs In SPANISH Presented at the 1st Argentine Congr. on Meteorol., Buenos Aires, Oct. 1970
(Ser-C-8) Avail: NTIS

The evaporation pattern for Argentina was studied, together with the relationship existing between evaporation, and lakes and ponds. Indirect calculation methods are considered. An analysis is included for the formulas used to calculate evaporation, as well as their graphical solution. A tentative evaporation isoline map for Argentina is presented, based on the values obtained from observation. Transl. by K.P.D.

N72-18619*# New York Univ., N.Y. Dept. of Meteorology and Oceanography.
SEVERE STORMS Annual Report
Melvin G. Goldstein Dec. 1970 11 p refs
(Grants NGL-33-016-013; NOAA-E22-101-70(G))
(NASA-CR-125614) Avail: NTIS CSCL 04B

The role of jet streams in the development of severe storms was analyzed. Local variations of flow resulting from rapid changes of geostrophic velocity along the air trajectory or inertial instability can produce cold advection. An analysis of meso-network data for 1968 and 1969 was performed. Although inertial instability was present in the network, local deviations in wind direction and cold advection were not detected. Author

N72-18620*# National Aeronautics and Space Administration., Goddard Space Flight Center, Greenbelt, Md.
JOINT MEASUREMENTS OF WIND AND TEMPERATURE STRUCTURE IN THE WINTER MESOSPHERE AT HIGH LATITUDES
I. J. Eberstein and J. S. Theon Jul. 1971 12 p refs Presented at AGU Fall Meeting, San Francisco, Dec. 1971 Submitted for publication
(NASA-TM-X-65815; X-651-71-334) Avail: NTIS CSCL 04B

An attempt to identify propagating internal gravity waves in the mesosphere was made by sounding the region with three instrumented rockets on January 13-14, 1970, from Churchill, Canada (59 N). The three observations, which were conducted at approximately 90 min. intervals, consisted of a pitot probe bracketed by two acoustic grenade soundings. Thus, two temperature and wind profiles and one density profile were obtained independently, permitting an examination of the thermodynamic structure and the wind structure. The results of the combined thermodynamic and wind observations were found to be quantitatively compatible with a gravity wave interpretation. This interpretation also predicts vertical velocities on the order of 10/msec in the 80 km region. Author

N72-18621*# Scientific Translation Service, Santa Barbara, Calif.
MICROMETEOROLOGIC TEMPERATURE MEASUREMENTS FROM AIRCRAFT
Dieter Lorenz Washington NASA Feb. 1972 12 p refs Transl. into ENGLISH from Ann. Meteorol. (Offenbach am Main), no. 3, 1967 p 154-158
(Contract NASw-2035)
(NASA-TT-F-14139) Avail: NTIS CSCL 04B

Industrially manufactured radiometers were used for airborne surface temperature measurements of the earth. The practicality of these measurements in micrometeorology and mesometeorology is shown by some examples. It is found that this kind of measurement is highly influenced by the type of surface. This influence may be reduced if the measurements are taken at an inclination of 30 to 45 deg from the horizontal, rather than vertically. Author

N72-18622*# Texas A&M Univ., College Station. Dept. of Meteorology.
TRANSFER OF THERMAL MICROWAVES IN THE ATMOSPHERE, VOLUME 1
Jack Frederick Paris May 1971 292 p refs
(Grant NGR-44-001-098; Contract Nonr-2119(04); Proj. 5013; Proj. Themis)
(NASA-CR-122356) Avail: NTIS CSCL 04B

The Mie theory is used to determine the absorption and scattering properties of liquid hydrometeors at 27 microwave frequencies from 500 MHz to 60 GHz. Based on the Marshall-Palmer distribution of drop sizes, regression equations are developed for the volume absorption coefficient of rain as a function of its temperature and content of liquid water. Author

N72-18623*# Texas A&M Univ., College Station. Dept. of Meteorology.
TRANSFER OF THERMAL MICROWAVES IN THE ATMOSPHERE, VOLUME 2
Jack F. Paris May 1971 234 p
(Grant NGR-44-001-098; Contract Nonr-2119(04); Proj. 5013; Proj. Themis)
(NASA-CR-122357) Avail: NTIS CSCL 04B

Figures and tabular information that are supplemental to a study on transfer of thermal microwaves in the atmosphere are presented. The numerical values for the absorption and scattering cross sections of a pure, liquid, water drop are given for drop diameters ranging up to 6 mm, and for various drop temperatures. These values were obtained through the Mie theory. For a Marshall-Palmer distribution of drop sizes, the volume absorption and scattering coefficients of rain are given for the same temperatures and microwave frequencies shown above and for contents of liquid water in the rain mass. Also, scattergrams are given of the katabatic and upwelling brightness temperatures of up to 582 model atmospheres over a calm ocean versus the equivalent depths of liquid water in cloud form, rain form, or combined cloud and rain form. Author

N72-18624# Joint Publications Research Service, Arlington, Va.
SCHEMATIZED MODEL OF A NONSTATIONARY TROPICAL HURRICANE
V. V. Shuleykin 28 Feb. 1972 7 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (Moscow), v. 200, no. 6, 1971 p 1336-1339
(JPRS-55286) Avail: NTIS

The development of a tropical hurricane above the ocean's surface is considered, at some given temperature, as well as the hurricane's abatement over land. The problem is solved analytically with application to a simplified pattern. Only the variation with time of air velocity in the hurricane system is considered, after the development of the initial eddy in the atmosphere. All the geometric parameters of the system itself are assumed to be invariant. K.P.D.

N72-18625*# Translation Consultants, Ltd., Arlington, Va.
ULTRAMICROSCOPIC INVESTIGATION OF ATMOSPHERIC AEROSOL PARTICLES
A. Nagy Meszaros Washington NASA Mar. 1972 8 p refs Transl. into ENGLISH from Idojaras (Budupest), v. 71, no. 4, Jul. - Aug. 1967 p 239-242
(Contract NASw-2038)
(NASA-TT-F-14136) Avail: NTIS CSCL 04B

The use of different types of ultramicroscopes to investigate the physical properties of atmospheric aerosols is discussed. Ultramicroscopy permits the study of aerosol particles in their gaseous environment without disturbing equilibrium conditions, and detects particles invisible under a conventional optical microscope. The smallest particles visible in the VDK-4 stream-flow type ultramicroscope have a radius of 0.058 micron. The spatial distribution of particle concentration can be determined under an ultramicroscope, and the VDK-4 was used to establish the fact that such distribution follows Poisson's law. Author

N72-18626# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
FIELD COMPARISON BETWEEN SLING PSYCHROMETER AND METEOROLOGICAL MEASURING SET AN/TMQ-22
Ronald W. Waite Ft. Monmouth, N. J. Aug. 1971 55 p refs
(AD-733293; ECOM-5399) Avail: NTIS CSCL 04/2

During the Service Check Test of Meteorological Measuring Set AN/TMQ-22, a discrepancy in dew point temperature readings was noted between it and the ML-224 Sling Psychrometer. From a series of independent tests designed to minimize error it was concluded that the AN/TMQ-22 yielded a more accurate dew point reading. The average relative humidity error using the sling psychrometer was -9% while the AN/TMQ-22 had a plus or minus 2% error. Even with cautious measurement the sling yielded a -4% error. GRA

N72-18627# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
THE NOISE CHARACTERISTICS OF SELECTED WIND AND TEMPERATURE DATA FROM 30-65 KM
Elton P. Avara and Bruce T. Miers Ft. Monmouth, N. J. Aug. 1971 34 p refs
(AD-733294; ECOM-5402) Avail: NTIS CSCL 04/2

Dual-tracked parachute soundings (two independent FPS-16 radars tracking the same parachute) and temperature soundings obtained within four hours of each other at White Sands Missile Range, New Mexico are used to estimate the error characteristics of the stratospheric wind velocity components and temperature measurements. It is found that a red noise model adequately describes the underlying structure of the errors. Author

N72-18628# Chicago Univ., Ill. Lab. for Atmospheric Probing.
DIGITAL PROCESSING OF FM-CW-RADAR DATA
Ernst Stratmann 16 Aug. 1971 41 p refs Prepared jointly with Illionis Inst. of Tech.
(Grant DA-ARO(D)-31-124-71-G71)
(AD-733295; TN-6) Avail: NTIS CSCL 04/2

Quantitative data recorded from a FM-CW radar provide a unique means of studying the microstructure of radar echoes from the clear atmosphere. A computer program is developed to compute reflectivity from digitized radar signal data, using a derived power calibration function, and correcting for range dependence of the received power. The report discusses the handling of the data and the derivation of the calibration equation, and present sample output from the computation including a contoured height-time record of reflectivity. Author (GRA)

N72-18629# Naval Postgraduate School, Monterey, Calif.
AN INVESTIGATION OF THE PROPERTIES AND INFLUENCE OF WAVE-INDUCED ORGANIZED MOTION IN THE ADJACENT AIRFLOW M.S. Thesis
Allen Jesten Frank Sep. 1971 83 p refs
(AD-733229) Avail: NTIS CSCL 04/2

Turbulence data obtained over natural water waves were analyzed using joint probability distribution and conditional means methods. These data represented conditions when the waves were decaying and when the waves were building. In both cases, significant wave-induced fluctuations were identified in the airflow. All features of the velocity fluctuations were examined for two levels above mean water level. In the case of a decaying wave field, decelerations in the airflow can be associated with an assumed propagating pressure maximum over the crest of the wave. Other than this deceleration, the airflow appears to reflect simple streamline bending over the mobile irregular wave surface. In the case of a building wave field, velocity fluctuations appear to agree with those predicted by linear wave generating theories. Author (GRA)

N72-18630# Naval Postgraduate School, Monterey, Calif.
EXPERIMENTS WITH A SIMPLE HURRICANE-INTERACTING OCEAN MODEL M.S. Thesis
Leino Bartholomew Corgnati, Jr. Sep. 1971 55 p refs
(AD-733226) Avail: NTIS CSCL 04/2

The equations developed by Riehl (1963) for a steady, symmetrical hurricane are used to specify a vortex over a fixed depth boundary layer, which interacts with a simple ocean model. Only vertical mixing in the surface layer is included in the oceanic portion of the model. Interaction of the atmosphere and the ocean occurs through the prediction of boundary layer parameters. Comparison of the predicted boundary parameters with observed mature tropical storms shows good agreement for all variables except the specific humidity, which exceeds saturation. Two attempts to correct for this situation have shown the proportion of the water vapor transported out of the top of the boundary layer without adding latent heat to the boundary layer appears to be an important factor in determining the intensity of a steady-state hurricane. Although the ocean model is quite simple, realistic horizontal oceanic temperature profiles with respect to the hurricane center were obtained. Author (GRA)

N72-18631# Air Weather Service, Scott AFB, Ill.
COMPARATIVE METEORLOGICAL TESTING OF THE AMT-13 DROPSONDE AND JOOX SERIES RAWINSONDE IN AN ENVIRONMENTAL WIND TUNNEL
Brian P. Severin Aug. 1971 90 p refs
(AD-733338; AWS-TR-222) Avail: NTIS CSCL 04/2

The test program described in the report was conducted at the Arnold Engineering and Development Center (AEDC), Tullahoma, Tennessee. The purpose of the test was to determine the accuracy and response characteristics of the temperature and relative humidity measurements made by the AMT-13 dropsonde and the JOOX-series rawinsondes. The temperature measurements of both types of sounding systems were found to be accurate to within plus or minus 1.0 degrees C and both would respond to temperature change rates equivalent to 5 degrees C per 1000 feet of vertical atmosphere without significant loss of accuracy. The humidity measurements of both systems were within the specified plus or minus 5% to 7% relative humidity accuracy, however, the AMT-13 dropsonde humidity accuracy degraded rapidly upon encountering liquid moisture. A shield to protect the dropsonde humidity sensor from direct moisture contact was fabricated and tested; it virtually eliminated the inaccuracies caused by the water contact. Author (GRA)

N72-18632# Naval Postgraduate School, Monterey, Calif.
COMPARISION OF EFFECTS OF VARIOUS TROPICAL STORMS ON THE VERTICAL TEMPERATURE STRUCTURE OF THE OCEAN USING PICTORIAL REPRESENTATION M.S. Thesis
William Revesz, Jr. Sep. 1971 55 p refs
(AD-733219) Avail: NTIS CSCL 04/2

To make comparisons of the effects of tropical storms on the ocean's vertical temperature structure, temperature-depth cross-sections were constructed using bathythermograph data and data from published articles. Upwelling, downwelling and mixing, caused by tropical storms in deep and shallow water, are analyzed and compared. For a slow-moving, intense and very intense tropical storm, upwelling, from a depth of 40 to 65 meters, is observed within the radius of hurricane-force winds. Downwelling as much as 20 meters occurs from 45 to 110 nmi from the path of the storm. This compares favorably with the theoretical results of O'Brien and Reid. A fast-moving, intense tropical storm has a similar effect on the vertical temperature structure if the thermocline is shallow, and upwelling, of a lesser degree than that caused by a slower-moving storm, can occur from a depth of 35 meters within the radius of hurricane-force winds. A very fast-moving, very intense tropical storm can cause upwelling from a depth of 30 meters if the thermocline is shallow. Author (GRA)

N72-18633# Iowa Inst. of Hydraulic Research, Iowa City.
EXPERIMENTAL PROCEDURE FOR THE DETERMINATION OF WAVE RESISTANCE IN A TOWING TANK
David D. Moran Aug. 1971 88 p refs
(Contract N00014-68-A-0196-0005)
(AD-733683; IIHR-133) Avail: NTIS CSCL 04/2

The technique, equipment, and experimental procedure presently used at Iowa Institute of Hydraulic Research to obtain a record of the water-surface profile at a fixed point as a ship model is towed past it, is described in detail. The equations and computer programs used to obtain the wave resistance of the ship model from the acquired data are also presented. GRA

N72-18634# Naval Weapons Engineering Support Activity, Washington, D.C.
FORECASTING HORIZONTAL WEATHER PREDICTION FIELDS BY SATELLITE AND NUMERICAL PRODUCTS
Fred E. Bittner Sep. 1971 56 p refs
(AD-733681; FAMOS-TM-3-71) Avail: NTIS CSCL 04/2

The report describes a quasi-objective technique for preparing 24- to 36-hour horizontal weather depiction forecasts, using a blend of numerically produced guidance material and weather satellite data. Relationships between the Fleet Numerical Weather Central (FNWC) 500-mb SD analysis and cloud patterns observed by weather satellites are illustrated. Objective methods for modifying the 500-mb SD progs, based on the satellite-observed cloud patterns, are described. Methods are outlined for forecasting precipitation areas, amounts and types, cloud types and cloud top heights. Verification techniques and results are presented. Author (GRA)

N72-18635# RAND Corp., Santa Monica, Calif.
NUMERICAL EXPERIMENTS ON THE RELATION BETWEEN MICROPHYSICS AND DYNAMICS IN CUMULUS CONVECTION
F. W. Murray and L. R. Koenig Sep. 1971 55 p refs
(Contract DAHC15-67-C-0141; ARPA Order 189-1)
(AD-733670; R-852-ARPA) Avail: NTIS CSCL 04/1

A previous numerical model of cumulus growth that treated condensation but not precipitation is modified by the addition of a parameterized treatment of liquid-phase microphysics. This modification improves the realism of the results for several parameters, including maximum height of cloud growth, maximum liquid content, amount and distribution of temperature departure, cloud shape, and occurrence and strength of subcloud down-draft. It is found that one of the most important controlling features in cloud growth is the rate of evaporation of droplets. In particular, the introduction of a class of large particles with a relatively slow evaporation rate produces a smaller temperature deficit at the cloud summit, hence more vigorous cloud growth. Author (GRA)

N72-18636# Meteorology Research, Inc., Altadena, Calif.
WARM FOG MODIFICATION STUDIES Final Report, 18 Aug. 1969 - 31 Aug. 1971
Theodore B. Smith 31 Aug. 1971 103 p refs
(Contract F19628-70-C-0069; AF Proj. 7605; AF Proj. 8620)
(AD-733671; MRI-71-978; AFCRL-71-0467) Avail: NTIS CSCL 04/2

A series of field experiments were carried out to investigate the treatment of warm fogs by hygroscopic materials. The program philosophy has involved strong interaction between physical observations made in the field experiment phases and computer modeling which attempts to simulate the treatment effects. An instrumented ground site was set up in October 1969 in the Noyo River Valley in northern California. Fourteen tests were carried out using a DC-3 aircraft and a helicopter to dispense hygroscopic material at the fog top. Extensive ground instrumentation recorded the effects of the treatment. Results of the Noyo Valley experiments led to the establishment of a semi-operational test program at McClellan AFB in Sacramento, California, in January 1971. C-130 aircraft and an Air Force helicopter were used as the seeding aircraft. A previous study was made at Forbes AFB in November 1970 to obtain dispensing characteristics from the helicopter. Ground instrumentation at McClellan recorded the results of the tests. It was found that the hygroscopic treatment could be carried out readily within the constraints of an operational base, using operational personnel for aircraft vectoring and dissemination. Author (GRA)

N72-18637# Atmospheric Sciences Office, White Sands Missile Range, N.Mex.
A STUDY OF CLOUD DYNAMICS UTILIZING STEREOSCOPIC PHOTOGRAMMETRY
William H. Hatch Mar. 1971 56 p refs
(AD-733284; ECOM-5368) Avail: NTIS CSCL 04/2

A case study in the utilization of stereoscopic photogrammetry in the investigation of cloud dynamics is presented. Analysis of a 30-minute period in the life of an orographic cloud shows a continuous series of turrets, each lasting approximately eight minutes, with peaks reaching 24,000 to 26,000 feet MSL. The methods of analysis and data reduction used are described, and the computer program written to perform the analysis computations is presented in the appendix. Author (GRA)

N72-18638# Army Foreign Science and Technology Center, Charlottesville, Va.
ERROR EVALUATION IN DETERMINING CONCENTRATION AND SIZE OF FOG DROPS WITH THE AELITA INSTRUMENT
L. G. Akulshina, V. N. Aref'yev, N. K. Nikiforova, and G. I. Shchelchkov 28 Oct. 1971 15 p refs Transl. into ENGLISH of unidentified Russian language article
(AD-733504; FSTC-HT-23-109-71; ACSI-J-9475) Avail: NTIS CSCL 04/2

The Aelita photoelectric counter can measure the drop size distribution spectrum in a range of radii from two to 15 microns with an error in measuring the smallest drops equal to 17.5 percent. As the drop concentration increases, the error in counting increases. However, the error contributed by the statistics of the recording could be compensated by a correction factor. When such correction is employed the measurement of drop concentration by the Aelita counter has an error that does not exceed seven percent at a concentration of not more than 2,000 drops per cubic centimeter. Evaluations made under the assumptions of this work show that errors caused by aspiration and diffusional precipitation of drops in the counter's collection device can be ignored. Author (GRA)

N72-18639# Environmental Technical Applications Center (Air Force), Washington, D.C.
DETERMINATION OF MAXIMUM EMISSION RATES TO MEET AIR QUALITY STANDARDS
A. Roger Greenway and David S. Lydon Aug. 1971 24 p refs
(AD-733505; USAFETAC-TN-71-9) Avail: NTIS CSCL 13/2

The report explains briefly the technique used to calculate for certain Air Force bases allowable stack emissions within the limits of the Environmental Protection Agency's Air Quality Standards. Examples of such calculations for Cape Kennedy AFS, Kelly AFB, and Tinker AFB are given. Graphs of Emission Rate vs Downwind Distances are furnished which allow downwind ground-concentrations of specific pollutants to be readily estimated for effective stack heights of 30, 50, and 70 feet. Author (GRA)

N72-18640# Environmental Technical Applications Center (Air Force), Washington, D.C.
CLOCK-HOUR/INSTANTANEOUS RAINFALL RATE RELATIONSHIPS APPLICABLE TO THE EASTERN UNITED STATES
Patrick J. O'Reilly Dec. 1971 25 p refs
(AD-733586; USAFETAC-Tn-71-12) Avail: NTIS CSCL 04/2

A methodology is described which provides climatological estimates of the frequencies of instantaneous rainfall rates at a point and along a surface horizontal path length as a function of the clock-hour rate. Clock-hourly precipitation amounts are utilized since they are available for a period of record for many first-order stations in the CONUS and for a selected number of overseas locations. Point instantaneous rainfall rates measured at Island Beach, New Jersey; Franklin, North Carolina; and Miami, Florida provided the input to these clock-hour/instantaneous rate relationships. These relationships are intended primarily for use over the Eastern United States but may find application for other areas. Author (GRA)

N72-18641# Transportation Systems Center, Cambridge, Mass.
CLEAR AIR TURBULENCE RADIOMETRIC DETECTION PROGRAM Annual Report, 1 Jul. 1970 - 30 Jun. 1971
George W. Wagner, G. G. Haroules, and Brown W. E. Jul. 1971 64 p Sponsored by FAA
(AD-733762; TSC-FAA-71-19) Avail: NTIS CSCL 04/1

The report presents a review of accomplishments for the Clear Air Turbulence Detection Program. The objectives, instrumentation, supporting hardware and interfaces leading up to and including the test flights for the reporting period are given. The ultimate goal of this program is the development of a remote method for detecting and thereby alerting high-altitude, high-speed aircraft in sufficient time to avoid the hazards associated with Clear Air Turbulence, CAT. Author (GRA)

N72-18642# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
ON THE ACCURACY OF ESTIMATING AVERAGES OVER GEOGRAPHIC AREAS
Rudolf Czelnai 30 Aug. 1971 21 p refs Transl. into ENGLISH from Idojaras (Budapest), v. 3, no. 6, 1969 p 340-350
(Contract F33657-71-D-0057; FTD Proj. 60103)
(AD-733808; FTD-HC-23-815-71; AP0028787) Avail: NTIS CSCL 04/2

A method for determining the probable errors of calculated area averages of meteorological elements is presented by the author. By using the so-called structural function of the stochastic field of the investigated element, the probable error of the estimated area average is expressed in functions of network-density and that of the respective area of averaging. The method is demonstrated by calculations concerning the accuracy of estimated area average rainfall depth. Author (GRA)

N72-18643# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THREE YEARS OF NUMERICAL METHODS AT THE SYNTOPIC SERVICE OF THE HYDROMETEOROLOGICAL INSTITUTE
Miroslav Skoda 23 Sep. 1971 16 p Transl. into ENGLISH from Meteorol. Zpravy (Prague), v. 23, no. 1, 1970 p 7-10
(Contract F33657-71-D-0057; FTD Proj. 60103)
(AD-733852; FTD-HC-23-818-71) Avail: NTIS CSCL 04/2

The paper describes the history of the application of numerical weather prediction methods in Czechoslovakia. It is being published on the occasion of the third anniversary of the beginning of operational computations of altitude patterns at the Hydrometeorological Institute. Author (GRA)

N72-18644# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
A NEW METHOD FOR MEASURING THE DISSIPATION RATE OF TURBULENCE IN CLOUDS AND PRECIPITATION USING A CONVENTIONAL RADAR
A. G. Gorelik and Yu. V. Melnichuk 22 Apr. 1971 15 p refs Transl. into ENGLISH from 3d Vsesoyuznogo Soveshch. Po Radiolokatsionnoi Meteorol., Tr. (Moscow), 1968
(Contract N00017-62-C-0604)
(AD-731558; CLB-3-T-629) Avail: NTIS CSCL 04/2

The report considers the possibilities of a radar operating with various sounding pulse lengths for the study of dynamic processes in the atmosphere. It is most expedient to use a radar emitting sounding pulses of different length alternately during a period of frequency iteration. The use of a two-channel selector with frequency selection at each F = b(sub rep)/2 permits the obtaining of radar signal envelopes and their spectra simultaneously for two pulse lengths. Then changes in the turbulence mode, scatterer-size spectra and mean wind speed will not affect the measurements of Epsilon. This technique will probably allow measurement of the temporal variations of Epsilon. Author (GRA)

N72-18645# Stanford Univ., Calif. Electronics Lab.
A LINE-OF-SIGHT MICROWAVE PROPAGATION EXPERIMENT FOR RESOLVING THE MOTIONS AND TURBULENT STRUCTURE OF THE ATMOSPHERE

Jeffrey C. Harp Aug. 1971 154 p refs
(Contract F19628-71-C-0050; AF Proj. 8682)
(AD-731573; SU-SEL-71-042; AFCRL-71-0451; SR-1) Avail: NTIS CSCL 04/2

The work is concerned with the problem of determining something of the nature of the turbulent atmosphere by studying the perturbations it induces upon a radio-wave which propagates through it. An experimental system is described which operates at a frequency of 34.89 GHz over a 28 km path. The receiver consists of an array of eight horizontally spaced antennas, and the transmitter consists of two horizontally spaced antennas which are time-shared by the receiving array. The data consist of amplitude and relative phase measured at each of the eight receiving points for both transmitters. The transmitters are alternated quite rapidly (relative to the characteristic time of the atmospherically induced fluctuations) so that from the data a variety of propagation geometries may be studied: one-transmitter-two-receiver, two-transmitter-one-receiver, and two-transmitter-two-receiver. The analyses consist primarily of calculating covariances between data channels (with and without time lags) for the various propagation geometries available. Author (GRA)

N72-18646# Alaska Univ., College. Geophysical Inst.
PROJECT SECEDE: TRACKING BARIUM RELEASES USING TH TV-TRACK SYSTEM Technical Report, 16 Dec. 1970 - 30 May 1971
T. Neil Davis and S. P. Geller 20 May 1971 42 p ref
(Contract F30602-70-C-0179; ARPA Order 1057)
(AD-731574; TR-2; RADC-TR-71-195) Avail: NTIS CSCL 04/2

Described herein is a TV tracking system capable of real-time visual object tracking. The total system consists of low-light TV cameras and communications allowing for data to be sent from remote sites to a small centrally located computer. The position of the object that the three cameras are observing is calculated by the computer and transmitted to other sites for the purpose of pointing other equipment. Solutions are available once per second. This report describes the actual use of this system during the SECEDE 2 test series and some problems encountered. It also contains enough detailed information to allow duplication of the system software or to extract certain portions of it that may be useful to other applications. Author (GRA)

N72-18647# Atmospheric Sciences Lab., White Sands Missile Range, N.Mex.
FORT WAINWRIGHT, ALASKA. ALASKA FIELD STATION. FOX LOWER ARCTIC MEDICAL RESEARCH LABORATORY Meteorological Data Report
Feb. 1971 50 p
(AD-731487) Avail: NTIS CSCL 04/2

The report contains the following meteorological data collected at sites within Fort Wainwright during February 1971: Atmospheric temperature; Atmospheric precipitation; Atmospheric pressure; Humidity; Wind. GRA

N72-18648# Army Electronics Command, Fort Monmouth, N.J.
MATHEMATICAL WIND GUST MODEL AND COMPUTER PROGRAMS FOR USE WITH AIRCRAFT SIMULATIONS
Robert W. Campagna Sep. 1971 73 p refs
(DA Proj. 1F1-63207-D-235)
(AD-733905; ECOM-3479) Avail: NTIS CSCL 20/4

A description is given of atmospheric turbulence and its spectral characteristics with emphasis placed on the application of this information to the aircraft equations of motion. The gust model developed accounts for not only the effect of body axis gust velocities applied at the center of gravity, but also includes the effect of gust gradients along the length and span of the aircraft. The latter effect is usually neglected but can be quite significant with small aircraft at high speeds. Thus, the model varies as a function of both aircraft size and velocity. An analog and digital model is developed for use with large-scale aircraft simulations or less sophisticated linearized aircraft models. Author (GRA)

21 NAVIGATION

Includes guidance; autopilots; star and planet tracking; inertial platforms; and air traffic control. For related information see also: 07 Communications.

N72-18649# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATE INCOMPATIBILITY BETWEEN GROUND AND AIRBORNE MEASUREMENTS OF VOR SPACE MODULATION Final Report, Jul. 1970 - Mar. 1971
Matthew Naimo, Jr. Feb. 1972 63 p refs
(Proj. 041-305-05X)
(FAA-NA-72-18; FAA-RD-71-119) Avail: NTIS

An investigation was conducted into the cause of incompatibility between ground and airborne measurements of VOR space modulation when using the latest flight inspection receiver, FA-4165.3A. The effort included a survey of the existing procedures and equipment used throughout the FAA, an evaluation of the ground measurement technique, and an evaluation of the airborne measurement technique. The investigation identified problem areas with both the ground and airborne techniques, but the largest contributing factor to incompatibility is due to the erroneous indication, at times, of the 30-Hz variable monitor output of the FA-4165.3A flight inspection receiver. Author

N72-18650# National Aviation Facilities Experimental Center, Atlantic City, N.J.
TEST AND EVALUATION OF ENGINEERING MODELS OF TERMINAL AREA DME Final Report, Feb. 1970 - Jul. 1971
George J. Hartranft Mar. 1972 81 p
(Proj. 330-018-01X)
(FAA-NA-72-25; FAA-RD-71-108) Avail: NTIS

Testing results are presented for two low-powered distance measuring equipment (DME). The equipments were delivered to National Aviation Facilities Experimental Center (NAFEC) to evaluate suitability of design concepts for use in preparing a prototype specification. The laboratory tests dealt with the effects of continuous wave interference on reply delay, receiver sensitivity, and squitter rate; the effect of various squitter rates on airborne interrogators, the effect of various interrogation levels on receiver delay, and the effects of various transmitted pulse parameters on the pulse pair spectrum. The flight tests identified the coverage area provided by a 90-watt DME ground station to various commercial and general aviation type DME interrogators. Author

N72-18651# Flight Standards Service, Washington, D.C.
EVALUATION OF VOR FIX LIMITATIONS Final Report
D. D. Murphy, Allan W. Hunting, and Frank Parr Feb. 1972 61 p
(Proj. FS-460-8)
(FAA-FS-600-4) Avail: NTIS

A flight evaluation of non-precision VHF omnirange (VOR) approaches to determine possible improvements in the final approach fix distance without derogation of procedure flyability is discussed. Two published VOR procedures and two additional VOR procedures designed for evaluation purpose were flown. Simulated instrument conditions were used for comparison of flyability problems on final approach distances of 3.5, 7.0, 10.5, and 18.5 nautical miles. It was concluded that distance measuring equipment, dual VOR receivers,or an improved timing device for distances greater than 7.0 miles should be used. Author

N72-18652*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MATRIX TRANSFORMATIONS FOR SPACECRAFT ATTITUDE DETERMINATION

David P. Cauffman (Natl. Acad. of Sci.) Jan. 1972 9 p refs
(NASA-TM-X-65824; X-645-72-35) Avail: NTIS CSCL 12A

A common problem for experimental space physicists is the determination of the attitude matrix T which transforms vectors between representations in X and X' coordinate systems according to (vector V sub X) = (T sub XX')(vector V sub X'). A straightforward, simple, and efficient solution for the transformation matrix is a double-cross transformation. It is calculated from any two directions A and B, which are vectors normalized to unit length and are known in both X and X' coordinates. The B direction need be known only well enough to define the plane in which vectors A and B lie. The problem of the intersection of two cones as applicable to attitude solutions is also discussed. Author

N72-18653# National Aviation Facilities Experimental Center, Atlantic City, N.J.
INVESTIGATE AND ANALYZE DME TRAFFIC LOAD Final Report, Mar. 1970 - May 1971
George J. Hartranft and Harold Postel Feb. 1972 27 p
(Proj. 330-006-07X)
(FAA-NA-72-24; FAA-RD-71-109) Avail: NTIS

The development of a method of measuring DME traffic for both a DME-saturated and non-saturated TACAN site is reported. DME traffic counts were conducted at the following Eastern Region VORTACs: LaGuardia, Robbinsville, Coyle, Kenton, Deer Park, Sea Isle, and Yardley. The LaGuardia VORTAC experienced the highest peak traffic of the VORTACs tested. The LaGuardia traffic count indicates the system is operating at 66 percent of full-load capacity during peak traffic. Author

N72-18654*# Massachusetts Inst. of Tech., Cambridge. Charles Stark Draper Lab.
APOLLO GUIDANCE, NAVIGATION, AND CONTROL: CANDIDATE CONFIGURATION TRADE STUDY, STELLAR-INERTIAL MEASUREMENT SYSTEM (SIMS) FOR AN EARTH OBSERVATION SATELLITE (EOS) Interim Technical Report
G. Ogletree, J. Coccoli, R. McKern, M. Smith, and R. White
31 Jan. 1972 229 p refs
(Contract NAS9-4065; DSR Proj. 55-39200)
(NASA-CR-115441; E-2630; ITR-2) Avail: NTIS CSCL 17/7

The ten candidate SIMS configurations were reduced to three in preparation for the final trade comparison. The report emphasizes subsystem design trades, star availability studies, data processing (smoothing) methods, and the analytical and simulation studies at subsystem and system levels from which candidate accuracy estimates will be presented. Author

N72-18655*# Northrop Corp., Huntsville, Ala. Electro-Mechanical Div.
ATTITUDE CONTROL SYSTEMS FOR LOAD RELIEF OF SATURN-CLASS LAUNCH VEHICLES
Jerry Sharp Feb. 1971 51 p refs
(Contract NAS8-20082)
(NASA-CR-61375) Avail: NTIS CSCL 17G

The effectiveness of attitude control laws that are designed to reduce bending moment loads and improve the controllability of large Saturn class boosters is discussed. These laws are referred to as load relief control systems. The two factors are assessed by simulations of varying degrees of complexity, from 2-D rigid body to 6-D with flexible body. A load relief control system, nicknamed AGE, is selected as the most effective of the various proposed schemes. This system is compared with other load relief laws and with simple attitude control. Most nominal vehicles use attitude control laws since their goal is to stay on the flight path without regard to the induced loads. Author

N72-18656*# Analytical Sciences Corp., Reading, Mass.
DYNAMIC ERRORS IN STRAPDOWN INERTIAL NAVIGATION SYSTEMS
Washington NASA Dec. 1971 301 p refs
(Contract NAS12-678)
(NASA-CR-1962; TR-147-3; M213) Avail: NTIS HC $6.00/MF $0.95 CSCL 17G

Motion-induced errors in strapdown inertial navigation systems are discussed. The errors generated in single-degree-of-freedom gyros and accelerometers are treated in great detail. These sensor errors are related to errors at the system level and common pulse rebalance techniques are compared. Since instrument single transmission characteristics are found to be important, describing function analysis is applied to nonlinear pulse torqued inertial sensor loops, and the results are compared with simulations. Two means for reducing motion-induced errors are explored: (1) selection of inertial sensor parameters, and (2) active error compensation by measuring the environment, computing the errors generated, and correcting for them. Author

N72-18657*# Control Data Corp., Minneapolis, Minn. Navigation and Space Systems.
FEASIBILITY STUDY OF SCANNING CELESTIAL ATTITUDE SYSTEM (SCADS) FOR EARTH RESOURCES TECHNOLOGY SATELLITE (ERTS) Final Report
Aug. 1971 122 p refs
(Contract NAS5-21552)
(NASA-CR-122361; RD-1102) Avail: NTIS CSCL 17G

The feasibility of using the Scanning Celestial Attitude Determination System (SCADS) during Earth Resources Technology Satellite (ERTS) missions to compute an accurate spacecraft attitude by use of stellar measurements is considered. The spacecraft is local-vertical-stabilized. A heuristic discussion of the SCADS concept is first given. Two concepts are introduced: a passive system which contains no moving parts, and an active system in which the reticle is caused to rotate about the sensor's axis. A quite complete development of the equations of attitude motions is then given. These equations are used to generate the true attitude which in turn is used to compute the transit times of detectable stars and to determine the errors associated with the SCADS attitude. A more complete discussion of the analytical foundation of SCADS concept and its use for the geometries particular to this study, as well as salient design parameters for the passive and active systems are included. Author

N72-18658*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
SYSTEM EVALUATION FROM IMPULSE RESPONSE FRAGMENTS
J. K. Baumeister (Computer Science Corp.) and E. H. Hopper
Washington Mar. 1972 21 p refs
(NASA-TM-X-2521; M-538) Avail: NTIS CSCL 17G

By use of rational approximation, a procedure was found which allows calculation of the z-transfer function from a restricted number of time sequence values. The order of the system need not be known. Transformation to the s-domain is easily provided. Author

N72-18659# National Aviation Facilities Experimental Center, Atlantic City, N.J.
EVALUATION OF TWO-BAY ANTENNA FOR VOR APPROACH MARKER BEACON Interim Report, Jul. 1970 - Sep. 1971
Wesley O. Mickey Mar. 1972 42 p
(Proj. 041-305-07X)
(FAA-RD-72-33; FAA-RD-72-11) Avail: NTIS

The Scanwell two-bay marker beacon antenna was installed and tested at three sites. Tests were performed with two aircraft, a T-29 aircraft and a flight inspection DC-3 aircraft. The DC-3 was equipped and calibrated as determined by the investigation of the marker beacon flight inspection system. Preliminary test at two sites, the asphalt Multiple Object Phase Tracking and Ranging (MOPTAR) site and 500 feet northwest of the MOPTAR site were performed with the T-29 aircraft. These tests determined that the Scanwell antenna radiation pattern provided the desired ratio 8:3 or higher, and that further testing was necessary to determine the power required to obtain the size pattern desired. Tests were performed with the DC-3 aircraft with the antenna installed at the approach end of runway 4. The output power tested of 1, 2, and 4 watts, was limited by the capabilities of the TV-26 transmitter. The power required to be assured of an 8,000-foot minimum major axis at 400 feet above ground level was 32 watts and was determined by projecting the increase of the radiation pattern observed when the power to the antenna was doubled. Author

N72-18660# Naval Postgraduate School, Monterey, Calif.
DETERMINATION OF STOL AIR TERMINAL TRAFFIC CAPACITY THROUGH USE OF COMPUTER SIMULATION M.S. Thesis
Robert Evans Rinker Sep. 1971 69 p refs
(AD-733185) Avail: NTIS CSCL 17/7

The capacity of an air terminal for Short Takeoff and Landing aircraft is analyzed. The terminal is considered to be operating as part of an intra-urban air rapid transit system. The air traffic flow through the terminal is modeled by a computer simulation written in both the FORTRAN IV and GPSS languages. The model is used to solve the traffic capacity problem under two sets of traffic control rules. In the first case, existing FAA rules, which require 3 miles separation between arrivals and 2 miles between an arrival and a departure, are used. In a second case, the rules are 2 miles between arrivals and 1 mile between an arrival and a departure. A detailed description of the model is presented so that others might use the model. Author (GRA)

N72-18661# Aerospace Corp., El Segundo, Calif. Office for Development Planning.
SYSTEM 621B GEOMETRIC PERFORMANCE FOR A 20 SATELLITE GLOBAL DEPLOYMENT, MARCH 1970 - MAY 1971
A. H. Bogen 5 Nov. 1971 55 p ref
(Contract F04701-71-C-0172)
(AD-733330; TR-0172(2521-01)-1; SAMSO-TR-71-230) Avail: NTIS CSCL 17/7

The report addresses the variation in System 621B global navigation performance due to the change in satellite orbital geometry with time. In addition, the report provides a detailed evaluation of satellite visibility, geometric dilution of precision, user received rf power, and satellite induced Doppler. Author (GRA)

N72-18662# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GYROSCOPIC DEVICES (CHAPTERS 2-17)
V. P. Danilin 8 Sep. 1971 693 p refs Transl. into ENGLISH from the book "Giroskopicheskie Pribory" Moscow, Izd-vo Vysshaya Shkola, 1965 p 70-535
(AF Proj. 6050)
(AD-733275; FTD-MT-24-307-70) Avail: NTIS HC $9.00/MF $0.95 CSCL 17/7

The book contains the following subjects: Gyro Horizons with Proportional (Radial) Correction; Gyro Horizons with Constant Correction in Several Directions; Gyro Horizons with Constant Radial Correction; Gyro Horizons with Mixed Correction in Several Directions; Certain General Questions on the Theory and Design of Gyro Horizons; Some Information About Gyro Compasses; Directional Gyroscopes (Directional Gyros); Gyromagnetic Compasses; Free Gyroscopes; Angular Rate Sensors (ARS) Based on Gyroscopes with Two Degrees of Freedom; Angular Rate Sensors Based on Gyroscopes with Three-Degrees-Of-Freedom; Certain Special Gyroscopic Instruments and Devices. Floating Gyroscopes; Single-Axis Power Gyroscopic Stabilizer. The Selection of the Parameters of the Stabilization System; Two-Axis and Three-Axis Gyrostabilizers. Power Gyro Horizons and Course-Verticals; Certain General Questions of Design; and Components of Gyroscopic Instruments. Author (GRA)

N72-18663# Pennsylvania Univ., Philadelphia. Moore School of Electrical Engineering.
INERTIAL NAVIGATION TASK Final Technical Report
Kenneth A. Fegley Oct. 1971 50 p refs
(Contract DA-28-043-AMC-02411(E); DA Proj. 1H1-62202-A-219)
(AD-733430; Rept-72-07; ECOM-02411-22) Avail: NTIS CSCL 17/7

The report is the final report for the task on research in the area of Inertial Navigation. The report summarizes the results of the main objectives which were to determine the feasibility of using a strapdown inertial system aboard a helicopter; to simulate systems which employ inertial elements; and to determine improved techniques to apply aided inertial navigation to Army aircraft. Author (GRA)

N72-18664# Southern Methodist Univ., Dallas, Tex. Information and Control Sciences Center.
AUTOMATIC NAVIGATION Interim Report, 1 Sep. 1970 - 31 Aug. 1971
Andrew P. Sage 31 Aug. 1971 54 p refs
(Contract F44620-68-C-0023; AF Proj. 9559)
(AD-733397; AFOSR-71-2965TR) Avail: NTIS CSCL 17/7

The contract is charged with conducting a program of predominantly theoretical research in the general field of optimal control with special emphasis on the estimation problem and automatic navigation. The twenty-one research summaries contained in the report document, in part, new research initiated since the last interim summary report. As evidenced by these summaries, the most noticable change from the efforts of previous years is the increasing emphasis of the research upon the application of optimum systems control and estimation theory to specific problems in automatic navigation. Author (GRA)

N72-18665# Mitre Corp., Bedford, Mass.
MODELS OF INFORMATION EXCHANGE AND DATA RATES FOR A POST-1975 AUTOMATED TACTICAL AIR CONTROL SYSTEM DEPLOYMENT
Emile A. Babineau and E. David Howes, Jr. Oct. 1971 165 p
(Contract F19628-68-C-0365; AF Proj. 603B)
(AD-733584; MTR-1875; ESD-TR-71-371) Avail: NTIS CSCL 17/7

Some changes in operations and technology will be introduced in the post-1975 TACS. Among these will be the use of digital secure voice and data management automation. To permit the development of Air Force ground environment communications requirements for the TACS of this era, estimated total point-to-point data rates are needed. The anticipated TACS operations, with some expected changes, are modeled. The resulting information exchange data rates for the total ground environment is about three megabits. This total data rate is impacted far more because of use of digital, secure voice than because of introducing data management automation. The two operational concepts which are modeled prove to have nearly identical data rate patterns. Author (GRA)

N72-18666# Transportation Systems Center, Cambridge, Mass.
EVALUATION OF AIR TRAFFIC CONTROL MODELS AND SIMULATIONS
L. O. Higgins and P. Mpontsikaris Jun. 1971 108 p refs Sponsored by FAA
(AD-733755; TSC-FAA-71-7) Avail: NTIS CSCL 17/7

Approximately two hundred reports were identified as describing Air Traffic Control (ATC) modeling and simulation efforts. Of these, about ninety analytical and simulation models dealing with virtually all aspects of ATC were formally evaluated. The bibliography lists all the reports identified. There is an introduction to, and a summary of the evaluation effort as of the publication. The summary contains a preliminary indication of which models may be of value for ATC concept evaluation; specifically traffic flow, safety and system loading aspects of proposed concepts. Author (GRA)

N72-18667# Transportation Systems Center, Cambridge, Mass.
OCEANIC SURVEILLANCE AND NAVIGATION ANALYSIS, FY 1971 Final Report
Ronald M. Hershkowitz Jun. 1971 84 p refs Sponsored by FAA
(AD-733758; TSC-FAA-71-13) Avail: NTIS CSCL 17/7

The report summarizes the oceanic surveillance and navigation analysis performed at Transportation Systems Center under PPA FA-04 for FY 71. Three major efforts are reviewed and discussed herein: summary of the North Atlantic Systems Planning Group collision risk model; a study of the impact of inertia air safety; an investigation of the modeling techniques required to assess the effect of air traffic control satellite surveillance on separation standards in the North Atlantic region. Author (GRA)

N72-18668# Transportation Systems Center, Cambridge, Mass.
TIME/FREQUENCY SYSTEMS
E. H. Farr, L. A. Frasco, H. D. Goldfein, and R. M. Snow Jun. 1971 87 p refs Sponsored by FAA
(AD-733761; TSC-FAA-71-17) Avail: NTIS CSCL 17/7

The report summarizes the work performed at DOT/TSC on the Time/Frequency ATC System study project. Principal emphasis in this report is given to the evaluation and analysis of the technological risk areas. A survey and description of proposed T/F system is included. The technical risk areas include the effects of multipath on signalling over radio links. Material is presented which bears on the comparative analysis of T/F with alternative technologies, including satellite and beacon-based system concepts. It is concluded that the most critical problem areas requiring further study are (a) multipath effects on T/F systems, and (b) systems operability under non-ideal conditions leading to graceful degradability. Author (GRA)

N72-18669# Transportation Systems Center, Cambridge, Mass.
A CONCEPTUAL NETWORK MODEL OF THE AIR TRANSPORTATION SYSTEM. THE BASIC, LEVEL 1 MODEL
Aurel N. DeHolland and Arthur S. Priver Apr. 1971 49 p
(AD-733752; TSC-FAA-71-3) Avail: NTIS CSCL 17/7

A basic conceptual model of the entire Air Transportation System is being developed to serve as an analytical tool for studying the interactions among the system elements. The model is being designed to function in an interactive computer graphics environment which permits rapid alteration of rules and parameters, as well as continuous real-time graphical monitoring of systems operations. The model described is the first member in an evolving hierarchy of increasingly complex models, progressing in the direction of closer approximation to the real-world Air Transportation System. Author (GRA)

N72-18670# Transportation Systems Center, Cambridge, Mass.
THE IMPACT OF INERTIAL NAVIGATION ON AIR SAFETY
R. M. Hershkowitz, D. OMathuna, and K. R. Britting (MIT Cambridge) May 1971 27 p refs
(AD-733753; TSC-FAA-71-5) Avail: NTIS CSCL 01/2

An analysis of inertial navigation system performance data was carried out to assess the probable impact of inertial navigation on the aircraft collision risk in the North Atlantic region. These data were used to calculate the collision risk between two aircraft flying at the same nominal flight level on adjacent tracks. The inertial system's error sources are treated in a statistical sense to infer the en route error behavior from the terminal error data. Collision risk estimates are derived for easterly and westerly transatlantic flights. Author (GRA)

N72-18671# Transportation Systems Center, Cambridge, Mass.
COLLISION RISK MODEL FOR NAT REGION
Ronald Hershkowitz May 1971 55 p refs
(AD-733754; TSC-FAA-71-6) Avail: NTIS CSCL 01/2

The paper reviews and summarizes the essential features of the collision risk model used to analyze the effects of separation standards on safety for the parallel tracking system employed in the North Atlantic. The derivation of the model is traced from a set of basic assumptions to formulation of various philosophies and a brief set of conclusions and recommendations for future work. A complete reference list is included. Author (GRA)

N72-18672# Applied Physics Lab., Johns Hopkins Univ., Silver Spring, Md.
PROGRAM REQUIREMENTS FOR TWO-MINUTE INTEGRATED DOPPLER SATELLITE NAVIGATION SOLUTION
John B. Moffett, ED. Sep. 1971 279 p refs Revised
(Contract N00017-62-C-0604)
(AD-731663; APL-TG-819-1-Rev) Avail: NTIS CSCL 17/7

The report describes the algorithms used in computing a navigation fix from data provided by receivers of the two-minute integrated doppler type designed to operate with the Navy Navigation Satellite System. The theoretical basis for calculating the change in range from the navigator to the satellite as a function of the integrated satellite doppler shift data is developed. The original receiver of the integrated doppler type, the AN/SRN-9, is briefly described in its developmental versions, designed by APL, and its production versions, built by ITT. The Scripps/ONR 702CA receiver, built by Magnavox and used for oceanographic research applications of integrated doppler navigation, is also described. The geometrical basis of the equations for obtaining a navigation fix is developed. The formatting and processing of the receiver data for the navigation solution are described preparatory to a presentation of step-by-step procedures for computing a three-variable navigation fix. Procedures for calculating satellite alerts, using data from the navigation solution, are also described. A representative FORTRAN program for obtaining a navigation fix and for calculating alerts is presented. Author (GRA)

N72-18673# Alabama Univ., Huntsville.
A STUDY OF PARAMETER-PLANE TECHNIQUES Final Technical Report
S. M. Seltzer Sep. 1971 83 p refs
(Contract DAAH01-70-C-0762)
(AD-733940) Avail: NTIS CSCL 12/1

Two general objectives were set forth at the beginning of the contract. The first concerned a study of the application of the parameter plane analysis technique to the analysis of rocket attitude control systems. In particular, it was desired to portray how domains of stability could be determined, how control system responses could be indicated, and how nonlinear characteristics of elements, such as rate gyroscopes and actuators which normally appear in missile hardware, might be incorporated in a stability analysis. A second objective was to use the parameter plane technique to analyze the application of an acceleration vector attitude control system to an Army rocket system. A third objective arose as an outgrowth of the first objective. This was to determine the suitability of applying the parameter plane analysis technique to the design of a sampled-data control system. Author (GRA)

N72-18674# Massachusetts Inst. of Tech., Cambridge. Measurement Systems Lab.
ASSESSMENT OF THE IMPACT OF GRADIOMETER TECHNIQUES ON THE PERFORMANCE OF INERTIAL NAVIGATION SYSTEMS Final Report, 1 Feb. - 31 Jul. 1971
Kenneth R. Britting, Stephen J. Madden, Jr., and Richard A. Hildebrant Sep. 1971 147 p refs
(Contract F19628-71-C-0105; AF Proj. 8607)
(AD-734051; RE-78; AFCRL-71-0465) Avail: NTIS CSCL 17/7

A parametric study is performed to compare the geodetic induced errors in inertial navigation systems with the errors introduced by the major inertial instrument uncertainties. Three performance classes of inertial systems are studied - production, state-of-the-art, and future. It is found that the geodetic induced errors have a proportionally greater effect on the velocity performance than on the position performance. Even for the

production systems, the geodetic errors are a large percentage of the total velocity error (about 50%). An inertial/gradiometer system is simulated in which the deflections of the vertical are computed and used for compensation of the inertial system.
Author (GRA)

22 NUCLEAR ENGINEERING

Includes nuclear reactors and nuclear heat sources used for propulsion and auxiliary power. For basic research see: 24 Physics, Atomic, Molecular, and Nuclear. For related information see also: 03 Auxiliary Systems; and 28 Propulsion Systems.

N72-18675*# Scientific Translation Service, Santa Barbara, Calif.
DESIGN AND OPTIMIZATION OF A FAST HEAT PIPE THERMIONIC REACTOR, 2
H. Hanke Washington NASA Feb. 1972 25 p ref Transl. into ENGLISH from Atomkernenergie (Munich), v. 18, 1971 p 143-150
(Contract NASw-2035)
(NASA-TT-F-14156) Avail: NTIS CSCL 18I

Optimization of reactor parameters for space flight applications is carried out using a variety of computer programs and graphical methods.
Author

N72-18676*# Scientific Translation Service, Santa Barbara, Calif.
DESIGN AND OPTIMIZATION OF A FAST HEAT PIPE THERMIONIC REACTOR, 1
H. Hanke Washington NASA Feb. 1972 31 p refs Transl. into ENGLISH from Atomkernenergie (Munich), v. 18, 1971 p 61-69
(Contract NASw-2035)
(NASA-TT-F-14157) Avail: NTIS CSCL 18I

The concept of an energy supply plant for space vehicles, consisting of a fast reactor as heat source and out-of-core thermionic converters heated and cooled by heat pipes, is designed and optimized. The criterion for optimization is the cost-to-power ratio. The costs are given by the price of the fissionable material and the expense for transport of the device into orbit. The reactor power is limited by the maximum tolerable values for the temperature at the free surface of a cell and for the output current of a single converter.
Author

N72-18677*# AiResearch Mfg. Co., Phoenix, Ariz.
NUCLEAR BRAYTON TURBOALTERNATOR-COMPRESSOR (TAC) CONCEPTUAL DESIGN STUDY
E. A. Mock and J. E. Davis Washington NASA Jan. 1972 321 p refs
(Contract NAS3-13448)
(NASA-CR-111565; APS-5355-R) Avail: NTIS HC $6.00/MF $0.95 CSCL 18I

A comprehensive analysis and conceptual design study of the turboalternator-compressor components was performed using HeXe as the working fluid. Individual turbine, alternator, compressor, and bearing and seal designs were evaluated. Six turboalternator-compressor TAC configurations were completed. One TAC configuration was evaluated to calculate its performance when operating under new cycle conditions,namely, one higher and one lower turbine inlet temperature and one case with krypton as the working fluid. Based on the results, a TAC configuration that incorportated a radial compressor, a radial turbine, a Lundell Alternator, and gas bearings was selected. A new layout of the TAC was prepared that reflects the cycle state points necessary to accommodate a zirconium hydride moderated reactor and a 400 Hz alternator. The final TAC design rotates at 24,000 rpm and produces 160 kWe, 480V, 3-phase, 400 hertz power.
Author

N72-18678*# Translation Consultants, Ltd., Arlington, Va.
THERMONUCLEAR REACTIONS THROUGH LASER RADIATION OF FUSION MATERIALS
E. Witalis Washington NASA Mar. 1972 22 p refs Transl. into ENGLISH of "Termonukleara Reaktor Genom Laserbestralning av Fusionmaterial", Rept. FOA-4 Defence Res. Inst., Stockholm, Jan. 1971 p 1-20
(Contract NASw-2038)
(NASA-TT-F-14085; FOA-4) Avail: NTIS CSCL 18H

The use of lasers for fusion weapons as well as for hydrogen energy is discussed. Criteria for an exothermic laser induced fusion process are formulated. An account of known calculations and estimations show that the existing laser systems are several magnitudes too small for direct use in fusion weapons or for peaceful use of hydrogen energy. However, it is shown that in combination with well established methods, generation and testing of a plasma with laser radiation would be feasible. Finally, the fields within laser and plasma physics in which important developments of laser-induced fusion processes can be expected are given.
Author

N72-18679*# Los Alamos Scientific Lab., N.Mex.
TRITIUM TRICK
W. V. Green, E. G. Zukas, and D. T. Eash [1971] 2 p Presented at Intern. Working Session on Fusion Reactor Technol. Conf., Oak Ridge, Tenn., 28 Jun. 1971 Sponsored by NASA and AEC
(NASA-CR-125608; LA-DC-12996; Conf-710624-2) Avail: NTIS CSCL 18J

Large controlled amounts of helium in uniform concentration in thick samples can be obtained through the radioactive decay of dissolved tritium gas to He3. The term, tritium trick, applies to the case when helium, added by this method, is used to simulate (n,alpha) production of helium in simulated hard flux radiation damage studies.
K.P.D.

N72-18680# Technische Hochschule Aachen (West Germany). Inst. fuer Eisenhuettenkunde.
APPLICATION OF THE THERMAL ENERGY OF A NUCLEAR REACTOR TO IRON ORE REDUCTION
F. R. Block and E. Wingen [1971] 14 p
(NP-19019) Avail: AEC Depository Libraries

The use of heat produced in a helium cooled reactor in an iron ore reduction process is described. The process contains an intermediate cycle in which liquid Pb is heated in a closed graphite tube heat exchanger by the helium from the reactor primary cooling circuit. The heated Pb passes on the heat to the iron ore through direct contact.
NSA

23 PHYSICS, GENERAL

Includes acoustics, cryogenics, mechanics, and optics. For astrophysics see: 30 Space Sciences. For geophysics and related information see also: 13 Geophysics; 20 Meteorology; and 29 Space Radiation.

N72-18681 California Univ., Los Angeles.
THE INITATION OF ISOTHERMAL BULK ELECTROCONVECTION IN DIELECTRIC FLUIDS Ph.D. Thesis
James Bertram Blackmon, Jr. 1971 271 p refs Supported in part by McDonnell-Douglas Astronaut. Co.
(Grant NSF GK-4089)
Copyright. Avail: Issuing Activity

The conditions governing the onset of bulk electroconvective motion in an isothermal dielectric fluid are analyzed using linear stability theory for a quasi-space-charge-limited current imposed on a planar fluid layer with two free surfaces, one free surface and one rigid surface, and two rigid surfaces. A quasi-space-charge-limited current initial state is developed that represents

the potential distribution spanning the extremes of Ohm's law dependence and the maximum space-charge-limited current expressions. In addition, the nonlinear mono-ionic current equation including diffusion is solved, using the Galerkin technique. This solution is also approximately valid for bi-ionic conduction in dielectric fluids if diffusion velocity is small compared to field-induced mobility, as is usually the case in the bulk liquid.
Author

N72-18682*# Arizona Univ., Tucson. Steward Observatory.
A 1:1 APOCHROMAT TRANSFER LENS SYSTEM
W. G. Tifft and R. A. Buchroeder 1 Dec. 1971 20 p
(Contract NSR-03-002-163; Grant NGR-03-002-153)
(NASA-CR-125604; T-71-20) Avail: NTIS CSCL 20F

A prototype system for remote control was constructed for the University of Arizona 90-inch telescope on Kitt Peak. The system uses image dissector tubes, a conventional photocell, and photographic plates as detectors for images formed at the Cassegrain focus of the 90-inch telescope. It was decided to use an image relay system to transfer selected portions of the image plane to image dissectors and the photographic plate. The design of a 1:1 relay system is described. Design considerations are discussed and alternate designs are outlined.
Author

N72-18683# Grumman Aerospace Corp., Bethpage, N.Y. Aerospace Section.
ANALYSIS OF MHD FLOW AND HEAT TRANSFER IN LAMINAR PIPE FLOW IN A RADIAL MAGNETIC FIELD
F. L. Fuller Feb. 1972 36 p refs
(RE-420) Avail: NTIS

A solution is obtained for the fully developed pipe flow problem for a conducting liquid in a radial magnetic field. The resulting velocity profiles and friction factors are valid over a large range of Hartmann numbers. Based on the new solutions for velocity, the energy equation, including the viscous and ohmic dissipation terms, is solved. Nusselt number is obtained as a function of Hartmann number and dimensionless temperature profiles are presented as a function of Hartmann number and a parameter dependent upon the ratio of ohmic heating to wall heat transfer. Large magnetic influence on the temperature profiles is shown to be possible.
Author

N72-18684# Northeastern Univ., Boston, Mass. Dept. of Physics.
APPARENT VIOLATION OF THE UNIVERSALITY HYPOTHESIS IN A LATTICE MODEL OF A PHASE TRANSITION
F. Y. Wu Jan. 1972 12 p refs
(Grant NSF GP-25306)
(NUB-2111) Avail: NTIS

A sixteen-vertex ferroelectric model was considered, which is related to an Ising model with a nonzero magnetic field. Using the established results on the Ising model, the nature of the phase transition of the model was deduced. As the value of a parameter (occurring linearly in the Hamiltonian) is varied, the model may exhibit a first-order transition, a second-order transition with an infinite specific heat, or no phase transition. The most significant change of the critical behavior occurs at a point where there is no apparent symmetry change in the Hamiltonian. This behavior is inconsistent with the universality hypothesis.
Author

N72-18685*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
EXPERIMENTS IN SPATIAL COHERENT OPTICAL FILTERING
Rudolph K. Larsen Jun. 1971 30 p
(NASA-TM-X-65828; X-711-71-292) Avail: NTIS CSCL 20A

Coherent optical techniques provide a means of processing entire pictures in parallel. Experiments were performed demonstrating the effectiveness of spatial frequency filtering in a coherent optical data processing system.
Author

N72-18686*# Techtran Corp., Glen Burnie, Md.
LIGHT SCATTERING IN A SPHERICAL MULTILAYERED ATMOSPHERE
L. G. Titarchuk Washington NASA Mar. 1972 49 p refs
Transl. into ENGLISH of "Rasseyaniye Sveta v Sfericheskoy Mnogosloynoy Atmosfere", Report PR-53 Acad. of Sci., Inst. of Space Res., Moscow, 1971 p 3-51
(Contract NASw-2037)
(NASA-TT-F-14189; PR-53) Avail: NTIS CSCL 20A

The multiple scattering of light in a multilayered spherical atmosphere of a planet is investigated with consideration of true absorption. Approximate solutions are obtained for the problem in a form convenient for numerical calculation. Evaluations of the approximations employed are given. Formulas are presented for calculating various light characteristics.
Author

N72-18687# International Business Machines Corp., Oswego, N.Y. Electronics Systems Center.
LIGHT INTERFACE TECHNOLOGY IMPROVEMENT INVESTIGATION Final Report, 1 Feb. - 30 Sep. 1971
Roy C. Clapper, Daniel J. Stigliani, Jr., and Harold H. Bloem 30 Sep. 1971 122 p refs See also related rept., AD-721085
(Contract N00014-71-C-0012; NR Proj. 215-166)
(AD-733076; Rept-71-531-007) Avail: NTIS CSCL 20/6

The report establishes a baseline model for an optical data link utilizing a single fiber bundle. This model is solely concerned with light interface technology (LIT) for digital signal transmission. Data link performance is characterized by the pulse amplitude, pulse rise and fall times, pulse delay, and signal-to-noise ratio of the photodiode output. The LIT link has been analyzed as an entirety considering four major areas; light emitting diodes, fiber optic light guide, fiber optic/diode interface, and photodiode. Fiber optic/diode interface has been investigated with regard to loss mechanisms of coupling light into and out of fiber bundles. Fiber optic light guides have been surveyed and evaluated. The three major types that have been given consideration are total internal reflection fibers, total internal refraction fibers and waveguide mode fibers. Space division multiplexing investigations considering Lambertian sources were completed for the TIR and SELFOC fiber types. Number of channels possible, optical cross coupling of fibers, and sampling effect are the main topics discussed. Analog properties of a typical link were investigated with respect to distortion. Experiments were completed using various wavelength LEDs and at various temperatures.
Author (GRA)

N72-18688# Admiralty Research Lab., Teddington (England).
MULTIPLE FREQUENCY STUDIES OF SOUND TRANSMISSION FLUCTUATIONS IN SHALLOW WATER
D. E. Weston, K. J. Stevens, J. Revie, and M. Pengelly Dec. 1970 22 p refs
(AD-733191; ARL/L/R75; BR-26814) Avail: NTIS CSCL 20/1

Studies of sound propagation in the shallow waters of the Bristol Channel were carried out between 1967 and 1969, with a systematic coverage of the seasons. Acoustic signals were transmitted and monitored by fixed bottom-laid transducers, the main path lengths being 17, 23 and 137 km. Transmissions consisted of a sequence of tone pulses, varying from 0.3 to 4.5 kHz. Both symmetrical and asymmetrical patterns of modal interference were seen, and it was deduced that at 23 km the number of effective modes was proportional to frequency. Seasonal changes were not marked at 17 and 23 km, but at 137 km there was about 30 dB extra loss in the summer. The latter is thought to be mainly due to fish attenuation, with a significant contribution from summer layering effects at the lower frequencies only. Five other types of amplitude fluctuation were seen, which it is hoped to report elsewhere.
Author (GRA)

N72-18689# ARO, Inc., Arnold Air Force Station, Tenn.
REFLECTANCES OF CO2 AND H2O CRYODEPOSITS AT SOLAR WAVELENGTHS Final Report, Jan. 1970 - Jun. 1971

B. A. Seiber, A. M. Smith, and B. E. Wood AEDC Nov. 1971 95 p refs
(ARO Proj. SW-5007; ARO Proj. VW-5122)
(AD-733326; AEDC-TR-71-241) Avail: NTIS CSCL 20/6

A careful study of the reflectances of carbon dioxide and water cryodeposits was made in a vacuum integrating sphere in the solar wavelength range (0.30 to 2.55 micrometers). These deposits were formed on liquid-nitrogen-cooled black epoxy paint and polished stainless steel substrates. The reflectances of these deposits were studied while varying the deposit thickness, view angle, and wavelength. The reflectance dependence on thickness was also predicted theoretically and the values obtained were in excellent agreement with the experimentally determined values. Most of the water deposits studied were of amorphous structure, but upon warming, the deposits crystallized resulting in a significant change in the reflectance. No structural changes were observed when the carbon dioxide frosts were warmed. From the results of this study, conclusions are drawn with regard to the application of these findings to several current problems.
Author (GRA)

N72-18690# ARO, Inc., Arnold Air Force Station, Tenn. Final Report, Jul. 1970 - Sep. 1971
ANOMALOUS REFRACTION MAXIMA IN THE BIDIRECTIONAL TRANSMITTANCES OF ROUGHENED DIELECTRIC SURFACES
A. M. Smith AEDC Nov. 1971 29 p refs
(Contract F40600-72-C-0003; ARO Proj. VW-5122; ARO Proj. VW-5205)
(AD-733327; AEDC-TR-71-248) Avail: NTIS CSCL 20/6

Bidirectional distribution measurements were made of the plane-polarized radiant flux transmitted through roughened glass samples having various surface roughnesses. These monochromatic measurements were made in the plane of incidence as a function of the irradiance zenith angle. For an irradiance angle of 0 deg, it is found that as the surface roughness-to-wavelength ratio increases the relative binormal transmittance of the glass decreases and the bidirectional transmission distributions become more diffusing but do not approach a Lambertian distribution. For off-normal irradiance angles and surface roughness-to-wavelength ratios significantly greater than unity, the maxima in the bidirectional transmission distributions of the roughened glass samples occur at zenith transmission angles smaller than those prescribed by the macroscopic application of Snell's refraction equation to a transmitting surface system. These transmission extrema have been termed anomalous refraction maxima and their angular displacement from the Snell direction is found to increase with increasing surface roughness and zenith incidence angle.
Author (GRA)

N72-18691# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THE ELECTROMAGNETIC FIELD OF A GROUNDED ELECTRIC DIPOLE AND A STRAIGHT CABLE ABOVE A HORIZONTALLY-LAYERED MEDIUM
A. V. Veshev, E. F. Lyubtseva, P. Samosyuk, and L. P. Fokina 24 Aug. 1971 42 p refs Transl. into ENGLISH from Vopr. Geofiz. (USSR), no. 18, 1968 p 89-119
(Contract F33657-71-D-0057)
(AD-733210; FTD-HC-23-337-71) Avail: NTIS CSCL 20/3

The paper calculates the electromagnetic fields of a grounded horizontal electric dipole and rectangular cable of finite length, supplied with a-c current of any frequency and situated at the ground air interface, the lower half space being horizontally stratified. The method used can be generalized for the case where the source is situated at any boundary or in any of the layers of the half space or in the air.
Author (GRA)

N72-18692# Massachusetts Inst. of Tech., Cambridge. Center for Materials Science and Engineering.
MATERIALS RESEARCH Annual Technical Report, Sep. 1970 - Sep. 1971
Dec. 1971 242 p refs
(Contract DAHC15-67-C-0222)
(AD-733482) Avail: NTIS CSCL 11/7

Contents: Chemical and solid state physics; Electronic, Magnetic, and Optical Properties of Materials and Device Applications; Metallurgy and Materials Science; Materials Engineering.
GRA

N72-18693# Massachusetts Inst. of Tech., Cambridge. Dept. of Metallurgy and Materials Science.
ON THE THEORETICAL AND EXPERIMENTAL STATUS OF MULTIBAND MULTIGAP SUPERCONDUCTIVITY: A REVIEW
Myron H. Frommer, Margaret L. A. MacVicar, and Robert M. Rose 17 Nov. 1971 34 p refs
(Contract N00014-67-A-0204-0041)
(AD-733455; TR-6) Avail: NTIS CSCL 20/12

In the report the authors summarized in detail the status of the two-gap, two-band theory of transition metal superconductivity and the fragmentary experimental data indicating the possibility that an s-gap does indeed exist. They also described the tunneling technique used in their laboratory to directly observe the second gap, as it has evolved in the last five years. The authors now stand poised for a definitive series of experiments to define the thermal behavior of both gaps. The results should resolve any doubt as to the existence of the second gap and also be a critical test of the SMW and other models of transition metal superconductivity.
Author (GRA)

N72-18694# Defense Documentation Center, Alexandria, Va.
NON-DESTRUCTIVE TESTING: METHODS, TECHNIQUES AND THEIR APPLICATIONS Report Bibliography, May 1964 - Mar. 1971
Dec. 1971 158 p refs
(AD-733850; DDC-TAS-71-58-1) Avail: NTIS CSCL 14/2

The bibliography as a compilation of references are grouped under eight major headings: (1) Lasers, (2) Eddy Currents, (3) Electrical, (4) Magnetic, (5) Visual, (6) Thermal, (7) Stresses, Pressure and Leak Testing, and (8) Miscellaneous.
Author (GRA)

N72-18695# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
SUPERSONIC ABSORPTION IN GASES
Hans H. Keller 13 Aug. 1971 18 p refs Transl. into ENGLISH from Z. Physik (Berlin), v. 41, no. 16, 1940 p 386-393
(AF Proj. 5710)
(AD-733810; FTD-HT-23-974-71) Avail: NTIS CSCL 20/1

The methods to measure ultrasonic absorption in gases optically that were developed by O. Petersen, were further developed. By measuring in argon a typic of calibration of the apparatus was obtained. As in argon, absorption measurements were conducted in nitrogen, ammonia, carbon dioxide and a mixture of carbon dioxide plus eight percent hydrogen at a fixed sound frequency and varied pressure. With the aid of theoretical considerations the results were recalculated to normal pressure and various frequencies and then discussed. The method is still capable of being improved from a measuring technical point of view.
Author (GRA)

N72-18696# Ohio State Univ., Columbus. Electroscience Lab.
INVESTIGATION OF 10.6 MICRON PROPAGATION PHENOMENA Semiannual Technical Report, 8 Jan. - 8 Jul. 1971
Stuart A. Collins Griffiss AFB, N. Y. RADC Aug. 1971 39 p refs
(Contract F30602-70-C-0003; ARPA Order 1279)
(AD-731572; ESL-2880-4; RADC-TR-71-202; SATR-4) Avail: NTIS CSCL 20/6

The report summarizes technical details of work performed at the Ohio State University Electro Science Laboratory during the period January 8, 1971 to July 8, 1971. Progress is reported on the design, construction, and testing of apparatus and computer software for an experiment on atmospheric imaging and image reconstruction at 10.6 microns. The initial experiment involves recording, in digital format, the atmospherically degraded images of a pair of point sources and is to be applied later to images received from laser illuminated real objects. Both experimental equipment data processing for image reconstruction are discussed. Preliminary data obtained by imaging an atmospherically degraded laser beam during recent tests at the RADC Verona PATS test site are presented. An analysis of errors resulting from tape drop-out during digital recording using a serial (Miller Code) technique is presented for both linear and logarithmic processing of the analog image data prior to recording. It is shown that linear processing is generally superior for the present digital system and hence is recommended. Author (GRA)

N72-18697# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
KERR CELL FOR THE HIGH SPEED MODULATION OF A LASER EMISSION
V. A. Gribkov, G. V. Sklizkov, S. I. Fedotov, and A. S. Shikanov 27 Sep. 1971 14 p refs Transl. into ENGLISH from Prib. Tekh. Eksp. (USSR), no. 4, 1970 p 213-216
(AF Proj. 1256)
(AD-733863; FTD-MT-24-977-71) Avail: NTIS CSCL 20/6

A method of obtaining ultrashort light pulses is described. A description of the Kerr cell used is described. A ruby laser emission of 4 x 10 to the -10th sec was used in a multiframe circuit in shadow photography to analyze the shock wave appearing during the expansion of the laser flame. Author (GRA)

N72-18698# Air Force Packaging Evaluation Agency, Wright-Patterson AFB, Ohio.
MAGNETIC SHIELDING, MARKINGS, AND LABEL REQUIREMENTS OF LGM-30 MINUTEMAN G AND C COMPONENTS
John A. Hincks Apr. 1971 14 p
(AF Proj. 69-28-D-154)
(AD-734052; DSPED-105) Avail: NTIS CSCL 20/3

The documents controlling military air shipments of magnetized materials do not specifically define what is and what is not considered magnetized materials, but do specify a maximum magnetic field strength of 0.00525 gauss at 15 feet and that items or palletized items must not exceed this to be safely shipped by military air. This project was established to determine the seriousness of the magnetic field strength given off by the Guidance and Control Components of the LGM-30 Minuteman Missile System to determine its effect on a magnetic compass. Author (GRA)

N72-18333*# California Univ., Berkeley.
ADDITIVE-COLOR IMAGE ENHANCEMENTS: TECHNIQUES AND EQUIPMENT
Jerry D. Lent *In its* Monitoring Earth Resources from Aircraft and Spacecraft 1971 p 9-14 ref (See N72-18331 09-13)
Avail: NTIS; SOD $4.00 CSCL 20F

N72-18436# National Bureau of Standards, Washington, D.C.
MATERIAL PROPERTIES
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 219-262 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

N72-18437# National Bureau of Standards, Washington, D.C.
IRRADIANCE STANDARDS
In its Precision Meas. and Calibration, Vol. 7 Nov. 1971 p 263-286 refs (See N72-18432 09-14)
Avail: SOD $7.00 as C 13.10:300/v.7

24 PHYSICS, ATOMIC, MOLECULAR, AND NUCLEAR

Includes atomic, molecular, and nuclear physics. For applications see: 22 Nuclear Engineering. For related information see also: 29 Space Radiation.

N72-18699# Hamburg Univ. (West Germany).
DEVELOPMENT AND CONSTRUCTION OF A LARGE SCATTER CHAMBER FOR HAMBURG'S ISOCHRONOUS CYCLOTRON Ph.D. Thesis [ENTWICKLUNG UND BAU EINER GROSSEN STREUKAMMER FUER DAS HAMBURGER ISOCHRON-ZYKLOTRON]
Clas Abels 1971 164 p refs In GERMAN
Avail: NTIS

Physical and technical concepts were used to construct a scattering chamber for the observation of nuclear reaction mechanisms and nuclear spectra of charged particles. Performance tests with the completed chamber proved satisfactory. Transl. by G.G.

N72-18700*# University of Southern Calif., Los Angeles.
[CHEMICAL PHYSICS OF MOLECULES AND CONTINUOUS CHANNEL ELECTRON MULTIPLIERS] Progress Reports, period ending 31 Oct. 1971
Darrell L. Judge 31 Oct. 1971 101 p refs
(Grant NGR-05-018-138)
(NASA-CR-125609; PR-1-3) Avail: NTIS CSCL 20H

The A approaches X, B approaches X and B approaches A bands of CO(+) have been excited using monochromatic photons and the band intensities measured. Using such data the variations of the electronic transition moments for these above emission bands as well as for the absorption bands have been determined. Further, the specific cross sections for the absorption processes have been determined by measuring the total emission intensity in the band system through which the upper state decays. The band intensity measurements and the derived results are presented. Author

N72-18701*# National Aeronautics and Space Administration, Washington, D.C.
ONE METHOD OF DETERMINING THE CHARGE OF HEAVY NONRELATIVISTIC PARTICLES
V. B. Semikoz Oct. 1971 31 p refs Transl. into ENGLISH of "Ob Odnom Metode Opred. Zaryadon Tyazh. Nerelyativistskikh Yader" Moscow, Acad. of Sci., USSR, Inst. for Space Res., Rept. PR-50, 1971 33 p
(NASA-TT-F-13767; PR-50) Avail: NTIS CSCL 20H

The problems involved in determining the charge of heavy particles having velocities in the nonrelativistic range are discussed theoretically. The assumptions which can simplify calculations from experimental data obtained from photographic tracks, and difficulties of other approaches are indicated. Based on mathematical analysis of various factors involved in study of tracks produced in photographic emulsions, formulas are deduced which give good results for nuclei of medium weight, but which are subject to some doubt (or need to be handled with some care) in the very high Z region. Author

N72-18702# Tokyo Univ. (Japan). Inst. of Space and Aeronautical Science.
ROTATIONAL TRANSITIONS IN PARA-HYDROGEN BY MOLECULAR COLLISIONS
Hisako Shimamura and Kazuo Takayanagi Oct. 1971 15 p refs
(ISAS-470-Vol-36-12) Avail: NTIS

The rotational transitions are studied in the distorted wave approximation. In the long-range part of the intermolecular force, the orientation-dependence of the dipole-dipole dispersion force and the quadrupole-quadrupole interaction are taken into account. In the short-range part of the interaction, the anisotropy parameter is determined empirically in such a way as the calculated rate constants explain the ultrasonic absorption data at 90 K. It is shown that the rotational cross sections can explain satisfactorily the ultrasonic absorption experiment at 90 and 293 K, but the agreement with the ultrasonic dispersion experiment is less satisfactory. The orientation-dependence of the long-range interactions and the simultaneous transitions in two colliding molecules are both found important. The cross sections are large when the collision partner is in an excited state of rotation. Author

N72-18703# California Univ., Berkeley. Aeronautical Sciences Div.

MOLECULAR BEAM STUDIES OF RELAXATION EFFECTS IN FREE JETS USING A CRYOGENICALLY COOLED SKIMMER

Raminder Singh Sep. 1971 156 p refs
(Grant NSF GK-11651)
(AS-71-7) Avail: NTIS

Axial speed distributions, absolute densities, and angular profiles of molecular beams extracted from hypersonic argon free jets were measured. Novel aspects include use of cryogenic preskimmers and an oscillographic matching of experimental and numerically-generated time-of-flight (TOF) curves. Results refuted previous observations of an indefinite improvement in skimming efficiency with increasing skimmer Knudsen number. A residue of parasitic effects precluded the definitive determination of jet parameters. Effects of post-skimmer collisions upon TOF data were noticed. Author

N72-18704# Norwegian Inst. of Tech., Trondheim. Dept. of Physics.

PENETRATION OF PARTICLES IN MATTER. A MONTE CARLO METHOD

K. Budal Sep. 1970 78 p refs
Avail: NTIS

A Monte Carlo method for simulating the paths of particles in matter is developed. The method is particularly simple, fast and takes litle memory space. A large number of typical particle transport problems are solved and generally found to be in good agreement with experimental results. Author

N72-18705*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PARTICLE-HOLE STATES IN Sn 120

Regis F. Leonard 31 Jan. 1972 9 p refs Presented at the Am. Phys. Soc. Meeting, San Francisco, 31 Jan. - 3 Feb. 1972
(NASA-TM-X-68004; E-6772) Avail: NTIS CSCL 20H

The 45 MeV deuteron beam from the Berkeley 88-inch cyclotron was used to study the particle-hole states in Sn-120. The present work resolved a number of individual levels and compared their strength and excitation energy with that observed in the Sn-120(d, He-3) reaction, which was also remeasured. A schematic diagram of the scattering system is given along with a description. A.L.

N72-18706*# Pittsburgh Univ., Pa. Space Research Coordination Center.

THE ATOM-MOLECULE REACTION D PLUS H2 YIELDS HD PLUS H STUDIED BY MOLECULAR BEAMS

J. Geddes, H. F. Krause, and W. L. Fite Feb. 1972 37 p refs
(Grant NGL-39-011-013)
(NASA-CR-125661; SRCC-165) Avail: NTIS CSCL 20H

Collisions between deuterium atoms and hydrogen molecules were studied in a modulated crossed beam experiment. The relative signal intensity and the signal phase for the product HD from reactive collisions permitted determination of both the angular distribution and HD mean velocity as a function of angle. From these a relative differential reactive scattering cross section in center-of-mass coordinates was deduced. The experiment indicates that reactively formed HD which has little or no internal excitation departs from the collision anisotropically, with maximum amplitude 180 deg from the direction of the incident D beam in center-of-mass coordinates, which shows that the D-H-H reacting configuration is short-lived compared to its rotation time. Non reactive scattering of D by H2 was used to assign absolute values to the differential reactive scattering cross sections. Author

N72-18707*# Pittsburgh Univ., Pa. Space Research Coordination Center.

EXCITATION OF THE WERNER BANDS OF H2 BY ELECTRON IMPACT

E. J. Stone and E. C. Zipf Feb. 1972 23 p refs Submitted for publication Sponsored in part by A. W. Mellon Educational and Charitable Trust, Maurice Falk Med. Fund, Richard King Mellon Found., and Sarah Mellon Scaife Found.
(Grant NGR-39-011-002; NGL-39-011-030; Contract DA-31-124-ARO(D)-440)
(NASA-CR-125595; SRCC-164) Avail: NTIS CSCL 20H

Absolute cross sections for the excitation of the H2 Werner band system were measured from energy threshold to 300 eV for electron impact on H2. The bands were observed in emission in the wavelength region 1100A to 1250A. The measured cross sections were compared with published transition probabilities, leading to the conclusion that the Werner bands are suitable as the basis for a relative spectral response calibration only when the bands are observed under sufficiently high resolution. The effect of the perturbation between the C 1Pi u and B 1 Sigma-u states of the hydrogen molecule was clearly observed in anomalies in the rotational intensity distribution in bands of the (3 v '') progression. Author

N72-18708# Lockheed Missiles and Space Co., Palo Alto, Calif.

ELECTRON CONCENTRATION AND TEMPERATURE PROFILES OF ELECTRONS IN THE 80-170 kM ALTITUDE RANGE

G. P. Komrakov, V. G. Khriukin, and Iu. K. Chasovitin [1971] 3 p refs Transl. into ENGLISH from Kosmich. Issled. (Moscow), v. 9, no. 5, 1971 p 791-793
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

An MR-12 rocket was used to measure the electron concentration and temperature profiles in a sporadic E layer of the ionosphere. The electron concentration was measured by a high frequency impedance probe, and the electron temperature was determined by using a cylindrical Langmuir probe. A detailed description of the measurement method and the apparatus used is given. The measurement accuracy was approximately 15% for the electron concentration, and + or - 100 K for the electron temperature. A.L.

N72-18709# Northeastern Univ., Boston, Mass. Dept. of Physics.

MATRIX ELEMENTS OF A MANY-BOSON HAMILTONIAN IN A REPRESENTATION OF CORRELATED BASIS FUNCTIONS

F. Y. Wu Dec. 1971 15 p refs
(Grant NSF GP-25306)
(NUB-2110) Avail: NTIS

The set of basis functions Psi = psi Pi(i) rho (k sub i) in which psi is a real correlation factor and rho (k) is the Fourier component of the density operator, is useful in describing the ground and low excited states of a many-boson system such as liquid He-4. The problem of computing the matrix elements of the Hamiltonian in this representation is considered. A closed expression is obtained for the general matrix element and examples which involve phonon splitting and coalescing states are given. Author

N72-18710# Iowa State Univ. of Science and Technology, Ames.

MODEL CALCULATION STUDIES OF THE TRANSPORT

PROPERTIES OF A DILUTE GAS OF DIATOMIC MOLECULES IN A STATIC MAGNETIC FIELD Ph.D. Thesis
Eugene Rex Cooper, II Aug. 1971 109 p refs
(Contract W-7405-ENG-82)
(IS-T-475) Avail: NTIS

Classical kinetic theory was used to determine the influence of external fields on the thermal conductivity and viscosity of a dilute gas of diatomic molecules. The emphasis is on the magnetic field effects, but the electric field effects for 1 Sigma molecules are also considered. To account for the inelastic collisions, it is assumed that the molecules are rigid and smooth, loaded spherocylinders, or loaded ellipsoids of revolution. The geometrical parameters for these models were obtained from comparisons of experimental and theoretical values for the transport coefficients. The Boltzmann equation for these molecules is discussed in detail, and approximate solutions of this equation nare considered. Author

N72-18711# Office of Naval Research, London (England).
THIRD INTERNATIONAL SYMPOSIUM ON MOLECULAR BEAMS ONR London Conference Report
I. Estermann 20 Oct. 1971 19 p refs Conf. held in Cannes, France, 29 Jun. - 2 Jul. 1971
(AD-733060; ONRL-C-24-71) Avail: NTIS CSCL 20/7

The report discusses the papers given at the third of a series of biennial symposia organized by the International Committee on Molecular Beams. The scope of the Symposium covered techniques and molecular beams instrumentation, with particular emphasis on nozzle beams, charge exchange beams, universal detectors, and time-of-flight measurements as well as experimental and theoretical studies of beam interactions with solids and elastic, inelastic and reactive collisions between molecules. Applications to atomic and nuclear physics were specifically excluded. About 40 papers originating in six US and about 30 European laboratories were presented. Author (GRA)

N72-18712# Stanford Univ., Calif. Dept. of Aeronautics and Astronautics.
A METHOD FOR THE EXPERIMENTAL STUDY OF VIBRATIONAL NONEQUILIBRIUM USING RESONANT RADIATIVELY DRIVEN ACOUSTIC WAVES
Richard C. Lind Sep. 1971 174 p refs
(Contract N00014-67-A-0112-0017; NR Proj. 061-167; RR Proj. 009-02-01)
(AD-733074; SU-SUDAAR-432; TR-3) Avail: NTIS CSCL 07/4

The work studied, experimentally and theoretically, the interaction of radiative and vibrational nonequilibrium in the motion of an infrared-active gas. Specifically, the study was concerned with acoustic waves caused in the infrared-active gas in a closed tube by a periodic input of radiation. The pressure response associated with these waves is measured and is compared with theoretical predictions. The resonant (or tuned) condition, in which the tube length is an integer multiple of one half the classical acoustic wavelength, with corresponding enhanced response, was of primary interest. A new and unique method of measuring resonance profiles of pressure amplitude and phase angle has been developed. These profiles are obtained by varying the wavelength of the acoustic wave about its resonant value. Theoretical solutions were obtained for the phenomena under study in the experiment, with particular emphasis on the interpretation of the measured resonance-profile information. The solutions are obtained by application of a basic model for the coupling of radiative and vibrational nonequilibrium in an infrared-active diatomic gas, developed in recent work by Gilles and Vincenti. Two types of solutions are discussed. Experiments were performed in pure CO2 and in various mixtures of CO with other gases. Author (GRA)

N72-18713# Naval Ordnance Lab., White Oak, Md.
DETERMINATION OF PICOGRAM AMOUNTS OF 99TC BY NEUTRON ACTIVATION ANALYSIS Final Report
S. Foti, E. Delucchi, and V. Akamian 23 Sep. 1971 18 p refs
(AD-733450; NOLTR-71-119) Avail: NTIS CSCL 07/5

Tc by the (n, gamma) reaction was used to determine picogram amounts of 99Tc in a highly purified aqueous medium. A rapid post-irradiation procedure was developed to purify and separate 100Tc fraction from other induced radionuclides in 40-45 seconds. The technetium yield of 53 plus or minus 5% was conducted in a low background beta-counter. Author (GRA)

N72-18714# Brown Univ., Providence, R.I. Div. of Engineering.
SHOCK WAVES STRUCTURED BY NONEQUILIBRIUM IONIZING AND THERMAL PHENOMENA
William H. Foley and Joseph H. Clarke May 1971 48 p refs
(Contract Nonr-562(36); NR Proj. 061-132)
(AD-731661; TR-25) Avail: NTIS CSCL 07/4

Ionizing shock waves in helium and argon are structured by nonequilibrium radiative and inelastic collisional transitions. The model atom of the monatomic gas has three electronic energy levels. The monatomic gas is not in local equilibrium with respect to population, and local translational equilibrium between the heavy species present and the electron gas is not assumed either. For the flow conditions studied the physics and morphology of the shock is further developed on a continuum basis from previous work, and the shock is found to consist of a far precursor due to radiative excitation, a near precursor due to radiative ionization, an embedded transport shock, an inelastic and thermal collisional relaxation zone, and an equilibrium radiating tail. Of particular interest in the results are the heating of the electron gas in the precursor by the said radiative and the associated de-exciting collisional mechanisms and the subsequent, electron-triggered collisional relaxation zone which is optically transparent to radiation; thus, nonequilibrium radiative and collisional processes are locally uncoupled throughout the shock. A family of numerical examples are displayed diagrammatically for an upstream temperature of 300 degrees K and upstream pressures between 1/1000 and 1/100,000 atmospheres. Selected were those accompanying downstream temperatures giving nominal equilibrium degrees of ionization of either 0.8 or 0.95. Author (GRA)

N72-18807# Centre National de la Recherche Scientifique, Paris (France). Centre de Spectrometrie Nucleaire.
EXPERIMENTAL DETERMINATION OF PROTON AND ALPHA PARTICLE INDUCED SPALLATION CROSS-SECTIONS IN OXYGEN, CARBON AND BORON
F. Yiou *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 118-133 refs (See N72-18799 09-29)
Avail: NTIS

25 PHYSICS, PLASMA

Includes magnetohydrodynamics. For applications see: 28 Propulsion Systems.

N72-18715*# Massachusetts Inst. of Tech., Cambridge. Center for Space Research.
OGO-1 AND OGO-3 MIT PLASMA EXPERIMENTS S4903 Final Project Report
30 Jun. 1968 208 p refs
(Contract NAS5-2053)
(NASA-CR-122351) Avail: NTIS CSCL 20I

Plasma proton and plasma electron prototype and flight models were designed, fabricated, and tested. Ground support equipment for the models was also prepared. The flight models were launched aboard the first and third Orbiting Geophysical Observatories on 4 Sept. 1964 and 6 June 1966. These experiments have generally functioned in accordance with the design specifications and useful data are still being received. K.P.D.

N72-18716*# Scientific Translation Service, Santa Barbara, Calif.
A STUDY OF THE MHD INSTALLATION U-O2 DURING PROLONGED OPERATION
V. A. Kirillin, A. Ye. Sheyndlin, B. Ya. Shumyatskiy, V. V. Kirillov, D. A. Vysotskiy, D. K. Burenkov, S. I. Pishchikov, P. G. Poletavkin, I. A. Mcstinskiy, V. I. Sukhov et al Washington NASA Mar. 1972 36 p refs Transl. into ENGLISH of "Issled. MGD Ustanovki U-O2 Pri Yeye Rabote v Dlitelnykh Rezhimakh" Moscow, Inst. of High Temp., Acad. Sci. USSR, 1971 30 p
(Contract NASw-2035)
(NASA-TT-F-14162) Avail: NTIS CSCL 20I

The main results of experimental studies obtained from 1965 to 1971 on the mock-up power installation U-O2 with a MHD generator are presented. A high temperature air heater was worked out in the U-O2 installation and long term operational tests (around 10,000 hours) were conducted. The possibility was demonstrated of the stable heating of air in this unit to 1,500 to 2,000 C. The distinctive features of the operation of various versions of combustion chambers for MHD installations were studied. An inlet system and three variants of the outlet system of the admixture were tested. The behavior of the admixture in the installation loop was investigated, particularly in the model steam generator. A multielement inverter facility using silicon thyristors was developed and tests were conducted. Major consideration was given to the results of investigating the characteristics of a MHD generator and the behavior of cold and hot structures of the MHD channel during its long-term operation. Author

N72-18717# Joint Publications Research Service, Washington, D.C.
ELECTRIC FIELD IN TOROIDAL METALLIC CHAMBER WITH SECTIONS
M. A. Stotland and Sh. V. Khil Oct. 1971 19 p refs Transl. into ENGLISH from the Russian report NP-18505
(AEC-TR-7276; NP-18505) Avail: NTIS

A quasi-stationary approximation was developed for an electric field in a toroidal metallic chamber with meridional sections and equatorial plane sections designed for the penetration of an induction electric field. Equations were also obtained for the electric field outside of the current-carrying surface of the toroidal loop with meridional cross section. Author (NSA)

N72-18718# Joint Publications Research Service, Washington, D.C.
STUDIES OF DIFFUSION OF DENSE DECAYING PLASMA IN A STELLARATOR
R. A. Demirkhandov, G. Baratov, N. I. Malykh, V. G. Merzhkin, M. A. Stotland, Yu. Ten, and Sh. V. Khil Oct. 1971 11 p refs Transl. into ENGLISH from the Russian report NP-18502
(AEC-TR-7273; NP-18502) Avail: NTIS

Helium plasma decay in a circular two-path stellarator with magnetic field variations from 6 to 12 kOe was studied under conditions in which the classical diffusion time is smaller than the Bohm time and the mean free path of electrons is considerably shorter than the system. It is shown that, taking into account the recombination elimination of charged particles, the plasma confinement time as a function of magnetic field intensity and angle of rotational transform can be determined accurately with the hydrodynamic model of classical plasma diffusion in a toroidal helical magnetic field. Author (NSA)

N72-18719*# California Univ., Los Angeles. Plasma Physical Group.
NONLINEAR EVOLUTION AND SATURATION OF AN UNSTABLE ELECTROSTATIC WAVE
B. D. Fried (TRW Systems), C. S. Liu, R. W. Means, and R. Z. Sagdeev Aug. 1971 15 p refs
(Grant NGL-05-007-190; Contracts N00014-69-A-0200-4023; AT(04-3)-34; Grant NSF GP-22817; Proj. 157)
(AD-730123; PPG-93) Avail: NTIS CSCL 20I

The nonlinear development and saturation of a single Langmuir wave driven unstable by a gentle bump in the tail of the distribution function in a collisionless plasma is studied by treating the resonant the particles numerically. Over a wide range of parameter values, the amplitude of the potential phi is found to saturate at such a level that the ratio omega (b)/gamma(o) is approximately equal to 3.2, where omega(b) = (ek sq phi/m)1/2 is the bounce frequency of the trapped particles in the wave trough and gamma (o) is the linear growth rate, approximately given by the classical Landau value. In view of the importance of inverse Landau damping for many instabilities, this work should have wide applicability and the results should be suitable for direct experimental tests. Author

N72-18720# Naval Postgraduate School, Monterey, Calif.
SPECTRAL ANEMOMETRY WITH AN ELECTROGASDYNAMIC PROBE M.S. Thesis
Ronald John Laib Sep. 1971 68 p refs
(AD-733232) Avail: NTIS CSCL 20/9

The study involves the measurement of RMS velocities covering the frequency spectrum 25 to 20,000 hertz using an electrogasdynamic (EGD) probe. Previous work proved the feasibility of this investigation. The flow of air behind a circular cylinder was measured. The freestream velocity was 185 ft/sec. Charged water droplets entering the wake through a jet in the cylinder at sonic velocity acted as the media for conveying information to the probe. Hot-wire anemometer readings made in the same spectral range were used as the standard of comparison. However, these need further refinement. Small droplet formation was optimized by determination and control of the relative humidity of the freestream, steam temperature and steam pressure. Optimum droplet charge was then determined and controlled with corona voltage. A 10 to 15 decibel increase in high frequency response and stable performance resulted. Author (GRA)

N72-18721# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
EXPERIMENTAL INVESTIGATION OF THE BREAKDOWN STRENGTH OF A MERCURY-CESIUM COLLOID Scientific Interim Report
Alan Pasquale Daurio Wright-Patterson AFB, Ohio ARL Aug. 1971 60 p refs
(Contract F33615-69-C-1114; AF Proj. 7116)
(AD-733329; ARL-71-0129) Avail: NTIS CSCL 20/9

An investigation of the breakdown strength of a mercury-cesium vapor undergoing condensation in the presence of helium was performed, using parallel wires as electrodes. An expression was derived which allowed the experimentally determined voltage to be related to the breakdown voltage for plane parallel electrodes. The breakdown relations thus derived were experimentally verified for Heg gas and air. Measurements were made at pressures of the order of half an atmosphere and for an electrode gap of the order of one millimeter. The breakdown voltage of the mercury-cesium colloid was found to depart considerable from the values for Heg. These departures were attributed to a high concentration of mercury in the early part of the experimental run, a velocity effect and Penning ionization of cesium atoms by matastable mercury atoms. The breakdown voltage ranged from a high of 732 volts to a low of 293 volts. The effect of condensation droplets was found to be a negligible contribution in the range investigated. Author (GRA)

N72-18722# Massachusetts Inst. of Tech., Cambridge. Div. of Sponsored Research.
THE EFFECT OF CONDENSATION ON THE BREAKDOWN STRENGTH OF A HELIUM-MERCURY MIXTURE
Daniel J. Fink Aug. 1971 81 p refs
(Contract F33615-69-C-1114; AF Proj. 7116)
(AD-733328; ARL-71-0128) Avail: NTIS CSCL 20/9

The effect of condensation on the DC breakdown strength of a helium-mercury mixture (helium at a reference pressure of one atmosphere with up to ten percent by weight of mercury) was calculated. The breakdown condition was determined by considering the electron current produced by ion bombardment of the cathode. The first Townsend coefficient was used as the parameter to describe breakdown. The first Townsend coefficient was computed by taking moments of the electron distribution function. The distribution function was calculated using a first order expansion in spherical harmonics of the distribution function in Boltzman's equation. The resulting equation for the distribution function was solved using integral and differential equation techniques in an iterative scheme. It was found that the presence of drops increased the breakdown strength by up to 88% over that of helium (with the Penning effect) without drops. Also, an analytical form for the contribution of drops to the first Towsend coefficient and an analytical method of estimating the increase in breakdown strength are presented. Author (GRA)

N72-18723# Naval Research Lab., Washington, D.C.

ELECTROMAGNETIC AND FINITE ELECTRON BETA EFFECTS ON THE MODIFIED TWO STREAM INSTABILITY

John B. McBride and Edward Ott Oct. 1971 14 p refs
(NRL Proj. 77H02-27)
(AD-733441; NRL-MR-2366) Avail: NTIS CSCL 20/9

When there is relative motion between electrons and ions across a magnetic field in a plasma, it has been shown theoretically that a modified two stream instability may develop. This instability has a fluid-like character and can interact strongly with the ions. Also, it is insensitive to the electron-ion temperature ratio. Previous analyses have been restricted to the electrostatic limit. In the paper the authors consider electromagnetic and finite electron beta effects on this instability. These effects are found to stabilize the instability in certain regions of the parameter space characterizing the plasma. Marginal stability curves are presented. Perhaps the most important result is that for waves which are likely to produce large ion heating, instability occurs provided U/(v sub A) approximately equals or - (1 - (beta sub e)) sup 1/2, where U is the relative drift speed and V sub A is the Alfven speed. The experimental significance of the results is discussed. Author (GRA)

N72-18724# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MULTIPLE IONIZATION IN POWERFUL SHOCK WAVE

T. S. Podstrigach 25 Aug. 1971 19 p refs Transl. into ENGLISH from Ukr. Fiz. Zh. (Ukrainian SSR), v. 15, no. 3, 1970 p 364-371
(AD-733208; FTD-MT-24-918-71) Avail: NTIS CSCL 20/9

The system of equations is formulated and numerically solved for the case of repeated ionization in a powerful shock wave propagating in weakly ionized hydrogen with insignificant admixtures of other elements. Parameters of the gas state are taken from other works where the structure of such a shock wave is examined taking into account de-excitation. Curves of the process of multiple ionization are given, and results of the calculation are discussed. Author (GRA)

N72-18725# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.

MEASUREMENT OF PLASMA ELECTRON TEMPERATURE BY MEANS OF A DIFFERENTIAL ANALYZER FOR CHARGED PARTICLE ENERGY

N. I. Alinovskii, Yu. E. Nesterikhin, and A. I. Rogozii 7 Sep. 1971 33 p refs Transl. into ENGLISH from Tr. Akad. Nauk SSSR. Inst. Yadern. Fiz. (USSR), 1968 p 1-31
(Contract F33657-71-D-0057; FTD Proj. 7JJ)
(AD-733205; FTD-HC-23-726-71) Avail: NTIS CSCL 20/9

The design of a differential analyzer of electron energy is described, and the method of measurement of a plasma electron temperature is substantiated. An analysis is also made of possible distortions of the energy spectrum of electrons introduced during measurements. Using the example of measurement of electron given temperature of a plasmoid generated by a conical induction source, the authors prove that the described method gives correct information in spite of contact. Maximum given values reach 150-250 eV. A weak preionization will not noticeably increase electron temperature; it only increases density and the total amount of particles in the plasmoid. A driving field results mainly in an increase of the directed energy of the plasmoid. Author (GRA)

N72-18726# Office of Naval Research, London (England).

THE PLASMA PHYSICS DIVISION OF THE EUROPEAN PHYSICAL SOCIETY

Alfredo Banos, Jr. 28 Sep. 1971 16 p
(AD-733409; ONRL-R-42-71) Avail: NTIS CSCL 20/9

The report gives an historical account of the formation of the Plasma Physics Division (PPD) of the European Physical Society (EPS), as well as some of the most recent achievements of the Division, particularly as regards conferences, meetings, and courses. Author (GRA)

N72-18727# Office of Naval Research, London (England).

THE INSTITUTE OF PLASMA PHYSICS AT THE NUCLEAR RESEARCH ESTABLISHMENT, JUELICH, WEST GERMANY

Alfredo Banos, Jr. 22 Sep. 1971 15 p refs
(AD-733407; ONRL-R-40-71) Avail: NTIS CSCL 20/9

The report gives a brief account of a liason visit to the Institut fur Plasmaphysik, which is one of the fourteen laboratories that constitute the impressive Kernforschungsanlage Julich (GmbH) near Aachen. The author reports that plasma physics and controlled fusion research has been intensified in the direction of confinement of high temperature plasmas, with main emphasis on the equilibrium and stability properties of axisymmetric compact magnetic field configurations. Besides a better understanding of collisionless shocks, the most notable recent achievement refers to the efforts to construct and operate a Tokamak-like toroidal device with values of beta in the vicinity of 10%, which is better than an order of magnitude larger than the low beta Russian Tokamaks. Author (GRA)

N72-18728# Office of Naval Research, London (England).

SUMMING-UP: MOSTLY ON PLASMA PHYSICS AND CONTROLLED THERMONUCLEAR FUSION IN EUROPE (FROM JANUARY 1967 TO SEPTEMBER 1971)

Alfredo Banos, Jr. 29 Oct. 1971 24 p refs
(AD-733410; onrl-R-43-7123) Avail: NTIS CSCL 20/9

The report gives an account of the trends, present progress, and prospects for the future in the field on controlled thermonuclear research (CTR) in Europe, as seen by the author. Author (GRA)

N72-18729# Aerospace Research Corp., Roanoke, Va.

CURRENT PRODUCTION IN A CYLINDRICAL GEOMETRY ELECTROFLUID DYNAMIC GENERATOR Final Report

Theodore L. Willke Oct. 1971 41 p refs
(AD-733706; ARL-71-0245) Avail: NTIS CSCL 10/2

The objectives of the study were (1) to determine the limiting factors on current production using the corona process of charging, (2) to uncouple or alleviate these limiting factors and (3) to increase the current density at high working pressures (ten atmospheres) to a significant level of current consistent with theory. Author (GRA)

N72-18730# Utah Univ., Salt Lake City. Microwave Device and Physical Electronics Lab.

[QUANTUM, SOLID STATE, AND PLASMA DIAGNOSTIC STUDIES] Consolidated Quarterly Report, 1 Jan. - 31 Mar. 1971

L. P. Anderson, R. L. Arnold, P. W. Chen, C. H. Durney, O. P. Gandhi, R. W. Grow, J. L. Hou, R. O. Miles, D. T. Rampton, M. K. Srivastava et al 31 Mar. 1971 105 p refs
(Contract N00014-69-C-0345; Grant NSF GK-16574; NR Proj. 373-740)
(AD-733070; MDL-Q36; UTEC-MD-71-171) Avail: NTIS CSCL 20/5

The broad purpose of the research activity reported herein is to extend the useful frequency spectrum into the range from microwave frequencies to optical frequencies and to improve existing devices and techniques in the microwave spectrum. At present this objective is being pursued by studies of electron beam devices, quantum electronic devices, plasmas, and solid-state devices. Author (GRA)

N72-18731# California Inst. of Tech., Pasadena.
TYPES OF INTERACTIONS IN SPACE-TIME PERIODIC MEDIA Interim Report
Charles Elachi Sep. 1971 27 p refs
(Grant AF-AFOSR-1935-70; AF Proj. 9768-02)
(AD-733730; AFOSR-71-2731TR; TR-59) Avail: NTIS CSCL 20/9

The interaction regions between two successive modes in a space-time periodic medium are studied. Geometrical criteria to determine the type of the interactions (stop-band, passive, amplifying or self-oscillating) from the Brillouin diagram are derived by using a first order Taylor series development. These criteria are applied to the cases of sinusoidally space-time periodic dielectric, plasma and uniaxial plasma; then the criteria are generalized for the case of generally space-time periodic media. Author

N72-18732# Minnesota Univ., Minneapolis. Dept. of Electrical Engineering.
STUDY OF COLLISION PROCESSES IN GASEOUS PLASMAS Final Report, 30 Nov. 1967 - 30 Jun. 1971
Hendrik J. Oskam Bedford, Mass. AFCRL Jul. 1971 22 p refs
(Contract F19628-68-C-0117; AF Proj. 4642)
(AD-731533; AFCRL-71-0407) Avail: NTIS CSCL 20/9

Results obtained from studying the properties of decaying plasmas are summarized. The measuring method consisted of measuring the number density of ion as well as the intensity of spectral lines and bands emitted by the plasma by mass spectrometer and light spectrometer techniques. The plasmas studied were produced in the rare gases, nitrogen, hydrogen and mixtures of these gases. The occurrence of various collision processes involving charged particles was established and the relevant reaction rate constants were determined. The production of charged particles by mutual collision between metastable particles was studied. Unknown processes resulting in the emission of nitrogen bands were found. Author (GRA)

N72-18733# Illinois Univ., Urbana. Coordinated Science Lab.
PARAMETRIC COEXICITATION OF ION-ACOUSTIC WAVES AND ELECTRON PLASMA WAVES BY A HIGH FREQUENCY ELECTRIC FIELD
David William Stowe Sep. 1971 168 p refs
(Contract DAAB07-67-C-0199)
(AD-733857; R-534; UILU-ENG-71-2237) Avail: NTIS CSCL 20/9

The basic theory of parametric coexcitation of ion-acoustic and electron plasma waves by a high frequency electric field is reviewed. Numerical calculations show that plasma-neutral collisions and steady state drift velocities have a significant influence on the interaction. Parametric excitation of ionacoustic waves is observed experimentally in a helium dc discharge. The observations indicate that the radial density profile of the dc discharge modifies the parametric effect. In the absence of an applied field, unstable electron drift-excited ion-acoustic waves are experimentally observed. These waves are found to satisfy the dispersion relation for a plasma consisting of He(-) and He 2(-) Author (GRA)

N72-18734# Illinois Univ., Urbana. Coordinated Science Lab.
THREE WAVE COUPLING IN A COLD BEAM-PLASMA SYSTEM
S. Tanaka and M. Raether Oct. 1971 63 p refs
(Contract DAAB07-67-C-0199)
(AD-733908; R-536; UILU-EN G -71-2239) Avail: NTIS CSCL 20/9

The coupling of 3 fixed phase waves in a cold beam-plasma system is discussed for all cases that result from locating the waves on the positive and negative energy branch. Explicit expressions are given for the spatial variation of the wave amplitudes including the influence of wave number mismatch and spatial growth rates. The coupling constants are computed for the decay and the explosive mode for representative beam and plasma parameters. Author (GRA)

26 PHYSICS, SOLID-STATE

Includes semiconductor theory; and superconductivity. For applications see: 16 Masers. For related information see also: 10 Electronics.

N72-18735# Toulouse Univ. (France).
MOS TRANSISTOR MODEL: INFLUENCE OF VARIATIONS IN CARRIER MOBILITY Ph.D. Thesis [MODELE DU TRANSISTOR MOS INFLUENCE DES VARIATIONS DE LA MOBILITE DES PORTEURS]
Georges Vassilieff 19 Oct. 1971 177 p refs In FRENCH
Avail: NTIS

General properties of MOS transistors and unidimensional models at constant mobility are considered. A study was conducted of the influence of an electric field on carrier mobility, for variation due to transverse and longitudinal fields. A model of a variable mobility MOS transistor is discussed. Various parameters of MOS transistors are also considered. Transl. by K.P.D.

N72-18736# Toulouse Univ. (France).
CONTRIBUTION OF THE CHARACTERIZATION OF SILICA-SILICON INTERFACES AS A MEASURE OF THE PROPERTIES AND STRUCTURES OF MOS Ph.D. Thesis [CONTRIBUTION A LA CARACTERISATION DES INTERFACES SILICE SILICIUM AU MOYEN DES PROPRIETES DES STRUCTURES MOS]
Pierre Vielcanet 20 Oct. 1971 126 p refs In FRENCH
Avail: NTIS

The transient response of a metal oxide semiconductor was analyzed. The various physical mechanisms are considered which are likely to generate minority carriers in the inversion layer. Behavior of the different structural types may be characterized on the basis of comparison of mechanism properties with experimental results. Transl. by K.P.D.

N72-18737*# North American Rockwell Corp., Anaheim, Calif.
INVESTIGATION OF SINGLE CRYSTAL FERRITE THIN FILMS Final Report
J. E. Mee, P. J. Besser, P. E. Elkins, H. L. Glass, and E. C. Whitcomb Feb. 1972 146 p refs Sponsored in part by AF and Army
(Contract NAS12-522)
(NASA-CR-112012; C71-973/501) Avail: NTIS CSCL 20L

Materials suitable for use in magnetic bubble domain memories were developed for aerospace applications. Practical techniques for the preparation of such materials in forms required for fabrication of computer memory devices were considered. The materials studied were epitaxial films of various compositions of the gallium-substituted yttrium gadolinium iron garnet system. The major emphasis was to determine their bubble properties and the conditions necessary for growing uncracked, high quality films. Author

N72-18738# Naval Research Lab., Washington, D.C.
REPORT OF NRL PROGRESS, JANUARY 1972
Jan. 1972 48 p
Avail: NTIS

The elastic interaction energy between point defects and a disk inhomogeneity lying in the basal plane of a hexagonally symmetric crystal was calculated from linear continuum mechanics. The disk inhomogeneity can be used as a model of a dislocation loop or a second-phase inclusion. From the elastic interaction energy, the motion of a point defect in the presence of a disk inhomogeneity can be predicted. These results indicate that the growth of a dislocation loop and shape evolution of a precipitate are dependent upon the volume changes produced by the point defect and the inhomogeneity in the elastic medium. Author

N72-18739# Istituto Superiore di Sanita, Rome (Italy). Lab. di Fisica.
EXCITON BINDING ENERGIES OF LAYER-TYPE SEMICONDUCTORS GaSe AND GaTe
M. Grandolfo, E. Gratton, F. AnfossoSomma, and P. Vecchia 27 Jul. 1971 18 p refs
(ISS-71/18) Avail: NTIS

Experimental results on the absorption coefficient of GaSe and GaTe single crystals near the fundamental edge are presented. An analysis of the direct exciton region due to Sell and Lawaetz was used to assign the energy position of the exciton levels and of the energy gaps, and to determine the exciton binding energies. Author

N72-18740# National Research Council of Canada, Ottawa (Ontario).
IMPEDANCE MEASUREMENTS ON THE MECHANISM OF ELECTROCRYSTALLIZATION OF SILVER
W. Lorenz 1972 7 p refs Transl. into ENGLISH from Z. Physik. Chem. (Frankfurt), v. 17, no. 112, 1958 p 136-140
(NRC-TT-1518) Avail: NTIS

By impedance measurements at the crystallization electrodes the following defining quantities of the electrocrystallization mechanism can be determined: (1) the probability of ionization of an ad-atom; (2) the relationship between the mean diffusion path of the ad-atoms and the mean growth line interval; and (3) the surface density of ad-atoms by two independent methods. All three quantities are determined experimentally on Ag/Ag(NH3)2(+) electrodes. The measurements were carried out on polycrystalline microelectrodes, some of them a few seconds after restoration of the electrode boundary face within the solution. Author

N72-18741# National Research Council of Canada, Ottawa (Ontario).
THE CREEP OF NaCl SINGLE CRYSTALS AT 500 TO 750 C
B. Ilschner and B. Reppich 1971 16 p refs Transl. into ENGLISH from Phys. Status Solidi (East Germany), v. 3, no. 11, 1963 p 2093-2100
(NRC-TT-1509) Avail: NTIS

Compression of NaCl in the <001> direction results in a slightly S-shaped initial creep curve. The temperature and stress dependence of the creep rate in the stationary range of this curve are investigated for resolved shear stresses between 25 and 75 g/sq mm. A theoretical interpretation is given on the basis that the nonconservative motion of jogs in screw dislocations is the rate-determining process. The creep-time curve becomes nonlinear after longer periods of time. Author

N72-18742# National Research Council of Canada, Ottawa (Ontario).
INTERPRETATION OF INTERNAL LATTICE DEFORMATIONS IN PLASTICALLY DEFORMED ALPHA-IRON
F. Bollenrath, V. Hauk, and W. Weidemann 1972 22 p refs Transl. into ENGLISH from Arch. Eisenhuettenw. (West Germany), v. 38, no. 10, 1967 p 793-800
(NRC-TT-1523) Avail: NTIS

X-ray studies were made of flat specimens of mild basic Bessemer steel with 0.018% C, after production of different dislocation structures by a 23% tensile deformation in the temperature range of 400 to 650 C, and at deformation rates of 0.00005 to 0.01/s quantitatively. The dislocation structures are described on the basis of the intensity distribution of X-ray reflections tangential to the Debye-Scherrer ring. The various dislocation structures were observed by transmission electron microscopy. X-ray measurements were made of the lattice constants with (310) and (211) diffraction lines. The internal lattice strains developing after plastic deformation were calculated, using different reflections and specimen forms. Author

N72-18743# Office of Naval Research, London (England).
ONE-DAY MEETING ON STABILIZING SUPERCONDUCTORS: MODERN METHODS AND PRESENT PROBLEMS
Robert A. Hein 1 Oct. 1971 13 p refs
(AD-732750; ONRL-C-18-71) Avail: NTIS CSCL 20/3

The report concerns a one-day meeting on stabilizing superconductors held at the Rutherford High Energy Laboratory, Rutherford, Berkshire, England, on 23 April 1971. A number of tutorial papers were presented on principles and practice of cryogenic, adiabatic and dynamic stabilization of superconducting wire and cables. Author (GRA)

N72-18744# Pennsylvania Univ., Philadelphia. Dept. of Physics.
RESONANT LIGHT SCATTERING BY SINGLE-PARTICLE ELECTRONIC EXCITATIONS IN N-GaAs
A. Pinczuk, L. Brillson, E. Burstein, and E. Anastassakis (Northeastern Univ.) Durham, N. C. AROD 29 Mar. 1971 6 p refs Repr. from Phys. Rev. Letters, v. 27, no. 6, 9 Aug. 1971
(Contract DA-31-124-ARO(D)-239; DA Proj. 2o0-61102-B-11-B)
(AD-733140; AROD-4882-19-P) Avail: NTIS CSCL 20/12

Resonant light scattering by single-particle excitations was observed in n-GaAs with incident photon energies near the (E sub 0) - (delta sub 0) optical energy gap. It is found that under extreme resonance conditions the spectra have two components with the scattered light polarization perpendicular and parallel to the incident light. These results are interpreted in terms of a random-phase-approximation theory. Author (GRA)

N72-18745# Carnegie-Mellon Univ., Pittsburgh, Pa. Dept. of Physics.
MOSSBAUER EFFECT APPLICATIONS: HYPERFINE INTERACTION OF Eu-151 IN Eu2TiO4
Chia-Ling Chien and F. deS. Barros Nov. 1971 16 p refs
(Contract N00014-67-A-0314-0005; NR Proj. 018-304)
(AD-733477; TR-12) Avail: NTIS CSCL 20/12

The hyperfine interaction of Eu-151 in Eu2TiO4 was measured using the Mossbauer effect. In this compound, the Eu (2+) site has four-fold symmetry (axially symmetric electric field gradient tensor). It was found that the nuclear quadrupole moment ratio of the first-excited to the ground states of Eu-151 is R = 1.34 + or - 0.03. The observed value of the quadrupole interaction energy is e2qQo = (190 + or - 7) MHz. Author (GRA)

N72-18746# Illinois Univ., Urbana. Dept. of Electrical Engineering.
INTERFACES AND BULK PHENOMENA IN SOLID STATE SCIENCE Final Scientific Report, 15 Sep. 1966 - 14 Sep. 1971
C. T. Sah 30 Sep. 1971 24 p refs
(Grant AF-AFOSR-0714-67; AF Proj. 9763)
(AD-733368; UILU-ENG-71-2556; AFOSR-71-2571TR) Avail: NTIS CSCL 20/12

Experimental and theoretical studies are undertaken on the electronic properties of surface and bulk regions of the interface between silicon and silicon oxide. Two electronic processes and their relationships to the atomic structures of the interface and to the electrical and optical characteristics of MOS devices are investigated. These are (1) scattering of electrons and holes by the imperfections at the interface region and the resultant mobilities, and (2) the surface state and oxide-trap state densities and their effects on the electron and hole trapping, generation and recombination rates, and on the low frequency 1/f electrical noise. Author (GRA)

N72-18747# Northrop Corporate Labs., Hawthorne, Calif.
RADIATION EFFECTS IN SILICON AND GERMANIUM Final Report, 26 Feb. 1969 - 15 Sep. 1971
J. R. Srour, O. L. Curtis, Jr., S. Othmer, and R. B. Rauch Washington Harry Diamond Labs. Aug. 1971 205 p refs
(Contract DAAG39-69-C-0039)
(AD-733446; NCL-71-29R; HDL-69-39-2) Avail: NTIS CSCL 20/12

The report describes the results of several related studies of radiation effects in silicon and germanium. Recombination parameters are determined for Co60 gamma-irradiated n-type germanium (low resistivity) and n-type silicon. A study of transient photoconductivity decay in the presence of traps for both irradiated and unirradiated silicon and germanium is presented. Measurements of the injection-level dependence of minority-carrier lifetime for n- and p-type silicon with neutron dose as a parameter are reported. Useful relationships for recombination studies are presented, including a method for determining capture-probability temperature dependences. Short-term annealing studies include an investigation of transient recovery in p-type silicon following pulsed 1.4-MeV electron irradiation and an analytical treatment of the effects of metastable charge states on short-term annealing in p-type material. Data are presented which indicate that heat-treated Czochralski-grown Al-doped silicon that undergoes an appreciable resistivity increase during heating at 450 C is significantly more resistant to both neutron and gamma irradiation than B-doped material. A technique for performing diffusion length measurements using a scanning electron microscope is described, and results of preliminary radiation effects studies on silicon employing this method are presented. Author (GRA)

N72-18748# Army Electronics Command, Fort Monmouth, N.J.
QUARTZ CRYSTAL UNITS FOR HIGH G ENVIRONMENT Research and Development Technical Report
Marvin Bernstein Nov. 1971 26 p refs
(DA Proj. 1S6-62705-A-058)
(AD-733285; ECOM-3497) Avail: NTIS CSCL 09/1

The design of small quartz crystal units, operating at the fundamental mode frequency of 15 to 23 MHz, which will survive shock acceleration amplitudes of 15,000 g:s and more is given. Test data on the number of failures and the permanent frequency change as a result of various levels of shock are shown. A new method of bonding the quartz resonator to the support, using electroplated nickel films with thickness of the order of 0.5 thousandths of an inch is discussed. Precautions in the processing of the quartz resonator are shown to be necessary to avoid destruction of the resonator at shock levels higher than 15,000 g's. Author (GRA)

N72-18749# Technion - Israel Inst. of Tech., Haifa. Dept. of Physics.
ELECTRICAL PROPERTIES OF TRANSITION METAL OXIDES UP TO 1800 C Final Scientific Report, 1 May 1970 - 30 Apr. 1971
D. S. Tannhauser 30 Aug. 1971 77 p refs
(Contract F61052-70-C-0024)
(AD-733354; ARL-71-0269) Avail: NTIS CSCL 20/12

The report treats three projects: The conductivity and the Hall effect of pure CoO and of CoO doped with titanium or chromium were measured. The measurements were done over a wide range of oxygen pressures and the range of temperatures was 988 to 1280 degrees C. The hole drift mobility in NiO single crystals was measured by optical injection. It was found that (mu sub p) = 0.3 sq cm/V-sec at room temperature. The method of epitaxial crystal growth of Cech and Allesandrini was refined with the aim of obtaining NiO crystals containing no more than 20 ppm total impurities and possibly better. Author (GRA)

N72-18750# Autonetics, Anaheim, Calif.
EPITAXIAL DEPOSITION TECHNIQUES Final Report, 1 Jul. 1969 - 30 Jun. 1971
Harold M. Manasevit, Frank A. Pizzarello, W. I. Simpson, A. C. Thorsen, and Ralph P. Ruth Nov. 1971 81 p refs
(Contract DAAB07-69-C-0452; DA Proj. 7X2-63304-D-215)
(AD-733428; C70-130/501; ECOM-0452-F) Avail: NTIS CSCL 11/3

A two-year program for development of epitaxial deposition techniques for the growth of thin films of semiconductor and piezoelectric materials for use in surface-wave acoustic devices is described. The work of the first eighteen months is summarized briefly and, the final six months of the program is discussed in detail, with emphasis on acoustic device fabrication and evaluation in ZnO and AlN films. The program has emphasized chemical vapor deposition of ZnO, AlN and GaAs, prepared by metalorganic-hydride reactions, on substrates of LiNbO3, Si, Al2O3, and certain other semiconductor and piezoelectric materials. GRA

N72-18751# Technion - Israel Inst. of Tech., Haifa. Dept. of Materials Engineering.
DETERMINATION OF DISLOCATION VELOCITIES AND DENSITIES FROM THE DEFORMATION WAVES OF DISCONTINUOUS YIELDING
Sol R. Bodner and Joseph Baruch May 1971 48 p refs
(Contract F61052-69-C-0042; AF Proj. 9782)
(AD-733733; MED-32; AFOSR-71-3027TR; SR-8) Avail: NTIS CSCL 20/12

The deformation waves that accompany the repeated discontinuous yielding of metals are analyzed with respect to utilizing their characteristics to determine dislocation velocities and densities as functions of stress and strain. Repeated yielding experiments were performed on annealed 2024 aluminum alloy and an alpha brass using a dead weight loading apparatus. Measurements were taken of deformation wave velocities and widths and the associated plastic strain increments and strain rates. The calculated dislocation velocities and densities appear to be reasonable and consistent. Author (GRA)

N72-18752# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RESPONSE OF HIGHLY DAMPED JUNCTIONS TO EXTERNAL LOW FREQUENCY NOISE CURRENTS
Helmut Kanter and Frank L. Vernon, Jr. 1 Nov. 1971 13 p refs
(Contract F04701-71-C-0172)
(AD-733720; TR-0172(9230-10)-5; SAMSO-TR-71-276) Avail: NTIS CSCL 20/12

The dc characteristics of superconducting point-contact junctions subjected to external noise currents are measured under the condition that the noise-frequency spectrum is below the Josephson frequency. It is shown that the curves are in agreement with a model based on modulation of the noise-free dc characteristic. Although in the low-bias-voltage region the shape of the curves is qualitatively similar to previous theoretical predictions for the case of high-frequency noise, for higher voltages the shapes are different. Quantitative differences exist over the whole range of bias voltage. Author (GRA)

N72-18753# Aerospace Corp., El Segundo, Calif. Lab. Operations.
SHOT NOISE IN JOSEPHSON POINT CONTACTS
Helmut Kanter and Frank L. Vernon, Jr. 1 Nov. 1971 14 p refs
(Contract F04701-71-C-0172)
(AD-733721; TR-0172(9230-10)-6; SAMSO-TR-71-277) Avail: NTIS CSCL 20/12

Experimental evidence is presented showing that the noise in Josephson point contacts is shot noise limited. Comparison with theory indicates that the pair current contribution is not as large as predicted. Author (GRA)

N72-18754# Aerospace Corp., El Segundo, Calif. Lab. Operations.
PHOTORESPONSE CHARACTERISTICS OF EXTENDED SURFACE BARRIER DIODES, NOVEMBER - DECEMBER 1970
David H. Seib 15 Aug. 1971 21 p refs
(Contract F04701-71-C-0172)
(AD-733725; TR-0172(9230-20)-2; SAMSO-TR-71-274) • Avail: NTIS CSCL 09/1

Surface barrier diodes which show a reversal of the photoresponse polarity with changing photon energy have been fabricated by diffusing Cu into heavily n-type GaAs. The photoresponse is found to depend strongly upon applied bias. These properties are explained in terms of a model in which a thin compensated region at the semiconductor surface allows the simultaneous photoemission of both holes and electrons from the metal into the semiconductor. Author (GRA)

N72-18755# Aerospace Research Labs., Wright-Patterson AFB, Ohio.
ELECTRON EMISSION STUDIES OF THE 2B-VIA SEMICONDUCTOR COMPOUNDS
Charles J. Vesely Aug. 1971 98 p refs
(AF Proj. 7885)
(AD-731551; ARL-71-0138) Avail: NTIS CSCL 20/2

X-ray induced electron emission measurements were used to determine the energy levels of core electrons in ZnO, ZnS, ZnSe, ZnTe, CdO, CdS, CdSe, CdTe, HgS, HgSe and HgTe. The investigated energy range extends from the bottom of the valence band (6-8 eV below the Fermi level) to about 1200 eV below the Fermi level. Chemical shifts were determined by comparing the results of these measurements with experimental values for the pure elements. These shifts are plotted as a function of the fractional ionicity values determined by Phillips and Van Vechten, Pauling and Coulson. Core level values for ZnSe and CdTe are compared with self-consistent relativistic orthogonalized plane wave calculations for the excitation energies of these compounds. Agreement with these theoretical calculations is best for the levels closest to the valence band and appears to be angular-momentum dependent. For the first time, spin-orbit splitting values were experimentally determined for several levels including Zn 3d, Cd 4d and Hg 5d levels. The measured energy values for the upper d-levels are compared with values obtained by ultraviolet induced electron emission, ultraviolet reflectivity and electron energy loss measurements. Author (GRA)

N72-18756# Lincoln Lab., Mass. Inst. of Tech., Lexington.
SOLID STATE RESEARCH, 1971 Quarterly Technical Summary, 1 May - 31 Jul. 1971
Alan L. McWhorter 15 Aug. 1971 64 p refs
(Contract F19628-70-C-0230; AF Proj. 649L)
(AD-731547; ESD-TR-71-247) Avail: NTIS CSCL 20/12

The report covers in detail the solid state research work of the Solid State Division at Lincoln Laboratory for the period 1 May through 31 July 1971. The topics covered are Solid State Device Research, Quantum Electronics, Materials Research, Physics of Solids, and Microelectronics. The Microsound work is sponsored by ABMDA and is reported under that program. Author (GRA)

N72-18757# TRW Semiconductors, Inc., Lawndale, Calif.
PRECISION QUARTZ CRYSTALS Final Report, May 1968 - May 1971
William H. H. Foulds Nov. 1971 115 p refs
(Contract DAAB07-68-C-0258; DA Proj. 1H6-62705-A-058)
(AD-733897; ECOM-0258-F) Avail: NTIS CSCL 09/1

The report covers work performed under contract to the U.S. Army Electronics Command, the prime objective of which was the development of processing techniques and a mounting system or systems that would produce fundamental model crystal resonators exhibiting extremely high frequency stability with time. Various mounting techniques were investigated, new processes in producing the metallic electrodes evaluated and new manufacturing procedures developed, which resulted in obtaining the desired aging rate. The results obtained during the final phase of the contract in which the refined processes and procedures so developed were coordinated to produce the Advanced Experimental Model requirement in both TO-8 and HC-6/U coldweld holder configurations are shown graphically. Author (GRA)

N72-18758# Army Electronics Command, Fort Monmouth, N.J.
BULK SEMICONDUCTOR QUASI-OPTICAL CONCEPT FOR GUIDED WAVES FOR ADVANCED MILLIMETER WAVE DEVICES
Metro M. Chrepta and Harold Jacobs Sep. 1971 42 p refs
(DA Proj. 1S6-62705-A-056)
(AD-733906; ECOM-3482) Avail: NTIS CSCL 09/1

Recent suggestions have been made for the design of bulk semiconductor millimeter wave devices, and in particular, a new type of phase shifter. In order for these designs to perform in a satisfactory manner it was found necessary to demonstrate that that electromagnetic propagation would occur largely in the interior of a semiconductor dielectric waveguide with relatively low loss. In this report an analysis is made of electromagnetic waves guided in an infinite slab of material with the properties of high resistivity silicon. Calculations and preliminary experiments are demonstrated at frequencies near 16.0 GHz. It is concluded that propagation in the semiconductor medium offers the possibility of low loss circuitry and satisfies the requisites for device design. Author (GRA)

N72-18759# Alabama Univ., University.
INFRARED DETECTION SYSTEM AND SOURCES RESEARCH Final Report, 2 Nov. 1970 - 1 Nov. 1971
R. B. Davidson Nov. 1971 28 p refs
(Contract DAAH01-71-C-0269)
(AD-733959) Avail: NTIS CSCL 20/12

X-ray damaged organic crystals were investigated for properties that would lead to potential microwave or infrared applications. Most of the work was performed on succinic acid and acetyl glycine crystals. Some work was done on maleic acid, L-alanine, acetyl-alanine and imidazole crystals for comparison. Crystals of the above materials were grown, X-ray damaged, and investigated using magnetic resonance techniques. The effects of an RF magnetic field on microwave absorption were studied using electron nuclear double resonance. Particular emphasis was placed on RF fields at the proton resonance frequency and multiples of this frequency. The magnetic resonance investigations were carried out using both X-band (9.5 GHz.) and K-band (25GHz.) equipment. Author (GRA)

27 PROPELLANTS

Includes fuels; igniters; and oxidizers. For basic research see: 06 Chemistry; and 33 Thermodynamics and Combustion. For related information see also: 28 Propulsion Systems.

N72-18760# Bureau of Mines, Pittsburgh, Pa. Energy Research Center.
CLEAN AUTOMOTIVE FUEL: LABORATORY-SCALE OPERATION OF THE SYNTHANE PROCESS
A. J. Forney, W. P. Haynes, J. J. Elliott, and R. F. Kenny Feb. 1972 8 p refs
(TPR-49) Avail: NTIS

A high-Btu gas was made in order to demonstrate the feasibility of using the gas as a nonpolluting fuel for automobiles. The pilot plants were revised to combine the processes of coal gasification, gas purification, and catalytic methanation into one overall system. Tests in test automobiles showed the Synthane gas was less polluting than natural gas. Author

N72-18761# Bureau of Mines, Bartlesville, Okla. Energy Research Center.
CLEAN AUTOMOTIVE FUEL: ENGINE EMISSIONS USING NATURAL GAS, HYDROGEN-ENRICHED NATURAL GAS, AND GAS MANUFACTURED FROM COAL (SYNTHANE)
D. B. Eccleston and R. D. Fleming Feb. 1972 15 p refs
(TPR-48) Avail: NTIS

Natural gas and mixtures of natural gas and hydrogen were used as fuels in a laboratory engine to determine the relationship of emissions to air-fuel ratio and to establish practical lean limits for air-fuel ratio. Synthetic gas manufactured from coal (Synthane) and natural gas were used as fuels in a vehicle to obtain comparative data on emissions and performance. Results showed that lean limits for air-fuel ratio when using hydrogen-enriched natural gas were extended significantly beyond that of natural gas. Synthane produced exhaust that was significantly less reactive than exhaust from natural gas. With lean air-fuel ratios, the acceleration performance of a vehicle fueled with Synthane was improved over its performance when fueled with natural gas. Author

N72-18762*# Martin Marietta Corp., Denver, Colo.
PASSIVE RETENTION/EXPULSION METHODS FOR SUBCRITICAL STORAGE OF CRYOGENS: TEST PLAN, SUBSCALE DUAL-SCREEN-LINER RETENTION/ EXPULSION SYSTEM
Ralph E. Hise Jul. 1971 24 p refs
(Contract NAS9-10480)
(NASA-CR-115395; MCR-71-38) Avail: NTIS CSCL 21I

A test program is described to demonstrate liquid-free gas venting of a subcritically stored cryogen using a passive retention/expulsion system. The test plan is specifically aimed at verifying this capability for the dual-screen-liner concept, independent of gravity level and direction. In addition, the test is designed to yield operational characteristics data for the dual-screen-liner, including: tank filling, frequency and duration of venting, cryogen temperature and pressure histories, sensitivity of pressure relief control, and the ability of the passive device to provide communication between the vapor annulus and bulk regions. Normal l-g aircraft and drop tower tests using nitrogen as the test liquid are discussed. D.L.G.

N72-18763*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
SPACECRAFT CRYOGENIC GAS STORAGE SYSTEMS
Gordon Rysavy [1971] 130 p refs
(NASA-TM-X-67546; MSC-01506) Avail: NTIS CSCL 21I

Cryogenic gas storage systems were developed for the liquid storage of oxygen, hydrogen, nitrogen, and helium. Cryogenic storage is attractive because of the high liquid density and low storage pressure of cryogens. This situation results in smaller container sizes, reduced container-strength levels, and lower tankage weights. The Gemini and Apollo spacecraft used cryogenic gas storage systems as standard spacecraft equipment. In addition to the Gemini and Apollo cryogenic gas storage systems, other systems were developed and tested in the course of advancing the state of the art. All of the cryogenic storage systems used, developed, and tested to date for manned-spacecraft applications are described. Author

N72-18764# Southwest Research Inst., San Antonio, Tex.
PHYSICAL AND CHEMICAL PROPERTIES OF JP-4 JET FUEL FOR 1970 Technical Report, 1 Jan. 1970 - 1 Jun. 1971
Robert K. Johnston, Charles M. Monita, and William A. Kemper Wright-Patterson AFB, Ohio AFAPL Sep. 1971 129 p
(Contract F33615-69-C-1231; AF Proj. 3048)
(AD-733352; SWRI-RS-577; AFAPL-TR-71-79) Avail: NTIS CSCL 21/4

Test reports on 5611 samples of JP-4 fuel purchased in 1970 have been analyzed to determine average properties and distribution of values for each of eight geographical districts, and the results have been compared with those of previous years. A significant trend toward lower-boiling fuel was noted. The frequency of values outside the specification limits was quite low, below 0.1% for most tests. Criteria and methods used in the present analysis have been listed, and suggestions have been made for improvements that can be made whenever a standardized test report form is available. Author (GRA)

N72-18765# Hercules, Inc., Magna, Utah. Bacchus Works.
LOW SHEAR MIXING Quarterly Report, 1 Jul. - 30 Sep. 1971
H. Douglas Dixon and Kenneth L. Harvey Edwards AFB, Calif. AFRPL Oct. 1971 37 p refs
(Contract F04611-71-C-0048)
(AD-733780; AFRPL-TR-71-124; QR-2) Avail: NTIS CSCL 21/9

A low shear mixing process and two propellant formulations were selected. The selected process consists of a combination of the desirable features of two propellant manufacturing concepts; the Batch Inert Diluent Process, and the Solid Phase Mixing Process. Process steps include mixing propellant in a diluent, pelletizing and freezing the propellant, diluent removal from the frozen pelletized propellant, vacuum casting, and subsequent pressure cure. Preliminary equipment design tests were conducted to confirm basic design criteria. Laboratory tests utilizing the binder system of the selected propellants and candidate diluents were performed to verify processibility and safety characteristics of the system. Author (GRA)

28 PROPULSION SYSTEMS

Includes air breathing, electric, liquid, solid, and magnetohydrodynamic propulsion. For nuclear propulsion see: 22 Nuclear Engineering. For basic research see: 23 Physics, General; and 33 Thermodynamics and Combustion. For applications see: 31 Space Vehicles. For related information see also: 27 Propellants.

N72-18766* National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
HEATED POROUS PLUG MICROTHRUSTOR Patent
William C. Isley and William C. Lund, inventors (to NASA) Issued 7 Sep. 1971 6 p Filed 6 Mar. 1970 Supersedes N70-35189 (08 - 19, p 3615)
(NASA-Case-GSC-10640-1; US-Patent-3,603,093; US-Patent-Appl-SN-17101; US-Patent-Class-60-260; US-Patent-Class-23-281; US-Patent-Class-23-288) Avail: US Patent Office CSCL 21H

A porous plug for application in spacecraft reaction jet controlled systems is described. Typical uses include pressure regulation and flow control, enhancement of propellant disassociation, and augmentation of heat transfer rays of propellants. For heated applications, operating temperature of the porous plug can be achieved using a resistance element, or, alternatively, a radioisotope source in the form of a porous plug, for purposes of controlling mass flow rate of propellant and improving specific impulse. Also, the heated porous plug may incorporate a high-heat capacity media for improving thermal storage properties. For unheated applications, the porous plug is utilized to provide both a stable passive liquid-vapor interface and a means for effecting contaminated insensitive pressure reduction device. Typical applications of the porous plug system are in station-keeping and attitude control reaction jet systems for earth satellites. Official Gazette of the U.S. Patent Office

N72-18767*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
OPERATIONAL CHARACTERISTICS OF A TRANSLATION SCREEN GRID BEAM DEFLECTION SYSTEM FOR A 5-CM KAUFMAN THRUSTER
Walter C. Lathem and Wayne R. Hudson Jan. 1972 15 p refs

(NASA-TM-X-68008; E-6782) Avail: NTIS CSCL 21C

Measurements of beam deflection angle with respect to spring positioning power and accelerator impingement current as a function of deflection angle were made on a 5-cm diameter system. Response time measurements on the translational grid beam deflection system showed that the time for the maximum deflection angle analyzed (+16.4 deg to -16.4 deg) could be reduced by a factor of nine by increasing the heating power applied to the positioning spring from 4 to 16 watts. At 14 watts the response time for maximum deflection was about 1 minute. Author

N72-18768*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN AND TEST OF POROUS-TUNGSTEN MERCURY VAPORIZERS

William R. Kerslake 1972 19 p refs Proposed for presentation at 9th Elec. Propulsion Conf., Washington, D. C., 17-19 Apr. 1972; sponsored by AIAA

(NASA-TM-X-68012; E-6792) Avail: NTIS CSCL 21C

Future use of large size Kaufman thrusters and thruster arrays will impose new design requirements for porous plug type vaporizers. Larger flow rate coupled with smaller pores to prevent liquid intrusion will be desired. The results of testing samples of porous tungsten for flow rate, liquid intrusion pressure level, and mechanical strength are presented. Nitrogen gas was used in addition to mercury flow for approximate calibration. Liquid intrusion pressure levels will require that flight thruster systems with long feed lines have some way (a valve) to restrict dynamic line pressures during launch. Author

N72-18769*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

ENGINE SELECTION FOR TRANSPORT AND COMBAT AIRCRAFT

James F. Dugan 1972 76 p refs Proposed for presentation at Conf. on Aircraft Performance: Prediction Methods and Optimization, Brussels, 24-28 Apr. 1972; sponsored by Advisory Group on Aeron. Res. and Develop.

(NASA-TM-X-68009; E-6783) Avail: NTIS CSCL 21E

The procedures that are used to select engines for transport and combat aircraft are discussed. In general, the problem is to select the engine parameters including engine size in such a way that all constraints are satisfied and airplane performance is maximized. This is done for four different classes of aircraft: (1) a long haul conventional takeoff and landing (CTOL) transport, (2) a short haul vertical takeoff and landing (VTOL) transport, (3) a long range supersonic transport (SST), and (4) a fighter aircraft. For the commercial airplanes the critical constraints have to do with noise while for the fighter, maneuverability requirements define the engine. Generally, the resultant airplane performance (range or payload) is far less than that achievable without these constraints and would suffer more if nonoptimum engines were selected. Author

N72-18770*# TRW Systems Group, Redondo Beach, Calif.

MONOPROPELLANT HYDRAZINE RESISTO JET Analysis Task Summary Report

F. B. Muenzer Nov. 1971 76 p refs

(Contract NAS5-11477)

(NASA-CR-122347; TRW-20266-6006-R0-00) Avail: NTIS CSCL 21H

Mathematical models for the electrothermal hydrazine thruster are provided which can be utilized to aid in preliminary design definition, interpretation of test data, and the evaluation of design and operational changes. Three computer programs were formulated to provide the necessary steady state and transient performance design tools. These included: preliminary evaluation of the energy balance characteristics of the thruster; a means of evaluating steady state performance relative to the primary design, configuration, and operational parameters; and a model to provide a means of evaluating transient (pulse mode) operation of the thruster relative to primary design and operational parameters. Author

N72-18771*# MacNeal-Schwendler Corp., Los Angeles, Calif.

COMPARISON OF THE SOLAR SAIL WITH ELECTRIC PROPULSION SYSTEMS Final Report

Richard H. MacNeal Feb. 1972 13 p refs

(Contract NAS7-699)

(NASA-CR-1986; MSR-13A) Avail: NTIS CSCL 21E

The propulsive efficiencies of the solar sail and of electric propulsion systems are compared on the basis of specific impulse. It is shown that the solar sail is more efficient at one a.u. for mission durations greater than about two months, that the advantage is increased for missions toward the inner planets, and that the same conclusions are reached when the comparison is based on maximizing the momentum transferred to the payload. Other factors that will influence the choice of a propulsion system for a specific mission are mentioned. Author

N72-18772# Aeronautical Research Labs., Melbourne (Australia).

EROSION TESTS ON A MODIFIED ROVER GAS TURBINE

G. A. Duke Jun. 1968 26 p refs

(ARL/ME-297) Avail: NTIS

As part of the research on burning coal in gas turbines, a Rover 1S/60 gas turbine was modified to facilitate running at reduced nozzle velocities and a series of tests was carried out, in which silica dust of known particle size ranges was fed into the combustion gas stream with a view toward correlating the erosion rate of the turbine components with the size and velocity of the eroding particles. Erosion rate was found to increase with particle size but at a diminishing rate as particle size increased. Extrapolation to smaller particle sizes indicated that no erosion would occur at mean particle sizes below 5 to 7 microns over the velocity range used. Increase in velocity was also found to increase the erosion rate but no consistent law could be found to relate the erosion rate to either gas or particle velocity. Author

N72-18773*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

PERFORMANCE OF TANDEM-BLADED TRANSONIC COMPRESSOR ROTOR WITH TIP SPEED OF 1375 FEET PER SECOND

Donald C. Urasek and David C. Janetzke Washington Mar. 1972 87 p refs

(NASA-TM-X-2484; E-6388) Avail: NTIS CSCL 21E

The design and experimental performance of a 20-inch diameter tandem-bladed axial-flow transonic compressor rotor is presented. Radial surveys were made of the flow conditions. At design speed the peak efficiency was 0.88 and occurred at an equivalent weight flow of 63 pounds per second. At peak efficiency the total pressure and total temperature ratios were 1.77 and 1.20, respectively. The stall margin at design speed was 10 percent based on weight flows and total pressure ratios at peak efficiency and near stall. Author

N72-18774*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

COMPUTER PROGRAM FOR PRELIMINARY DESIGN ANALYSIS OF AXIAL-FLOW TURBINES

Arthur J. Glassman Washington Mar. 1972 38 p ref

(NASA-TN-D-6702; E-6603) Avail: NTIS CSCL 21E

The program method is based on a mean-diameter flow analysis. Input design requirements include power or pressure ratio, flow, temperature, pressure, and speed. Turbine designs are generated for any specified number of stages and for any of three types of velocity diagrams (symmetrical, zero exit swirl, or impulse). Exit turning vanes can be included in the design. Program output includes inlet and exit annulus dimensions, exit temperature and pressure, total and static efficiencies, blading angles, and last-stage critical velocity ratios. The report presents the analysis method, a description of input and output with sample cases, and the program listing. Author

N72-18775*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

FAN AND WING FORCE DATA FROM WIND TUNNEL INVESTIGATION OF A 0.38 METER (15 INCH) DIAMETER VTOL MODEL LIFT FAN INSTALLED IN A TWO DIMENSIONAL WING

Joseph A. Yuska and James H. Diedrich Washington Mar. 1972 101 p refs
(NASA-TN-D-6654; E-6607) Avail: NTIS CSCL 21E

Test data are presented for a 38-cm (15-in.) diameter, 1.28 pressure ratio model VTOL lift fan installed in a two-dimensional wing and tested in a 2.74-by 4.58-meter (9-by 15-ft)V/STOL wind tunnel. Tests were run with and without exit louvers over a wide range of crossflow velocities and wing angle of attack. Tests were also performed with annular-inlet vanes, inlet bell-mouth surface disconuities, and fences to induce fan windmilling. Data are presented on the axial force of the fan assembly and overall wing forces and moments as measured on force balances for various static and crossflow test conditions. Midspan wing surface pressure coefficient data are also given.
Author

N72-18776*# Fairchild Hiller Corp., Farmingdale, N.Y. Republic Div.

TASK 1, DESIGN ANALYSIS REPORT: PULSED PLASMA SOLID PROPELLANT MICROTHRUSTER FOR THE SYNCHRONOUS METEOROLOGICAL SATELLITE Interim Report, Jul. - Nov. 1971

William J. Guman, ed. Dec. 1971 133 p refs
(Contract NAS5-11494)
(NASA-CR-122358; PCD-TR-71-7; FRD-4070; PC145R8000) Avail: NTIS CSCL 21C

Thermal vacuum design supporting thruster tests indicate no problems under the worst case conditions of sink temperature and spin rate. The reliability of the system was calculated to be 0.92 for a five-year mission. Minus the main energy storage capacitor it is 0.98.
Author

N72-18777*# North American Rockwell Corp., Downey, Calif. Space Div.

IMPROVED SCALING LAWS FOR STAGE INERT MASS OF SPACE PROPULSION SYSTEMS. VOLUME 1: SUMMARY

Jun. 1971 71 p
(Contract NAS2-6045)
(NASA-CR-114419; SD-71-534-1-Vol-1) Avail: NTIS CSCL 21H

Summarized is a study which satisfies the need for improved scaling laws for stage inert mass of space propulsion systems. The resulting laws are applicable to current and future vehicle systems and designs for a comprehensive spectrum of anticipated planetary missions.
Author

N72-18778*# North American Rockwell Corp., Downey, Calif. Space Div.

IMPROVED SCALING LAWS FOR STAGE INERT MASS OF SPACE PROPULSION SYSTEMS. VOLUME 2: SYSTEM MODELING AND WEIGHT DATA

Jun. 1971 427 p refs
(Contract NAS2-6045)
(NASA-CR-114420; SD-71-534-2-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

Technical models and analytical approaches used to develop the weight data for vehicle system concepts using advanced technology are reported. Weight data are supplied for the following major system elements: engine, pressurization, propellant containers, structural shells and secondary structure, and environmental protection shields for the meteoroid and thermal design requirements. Scaling laws, improved and a simplified set, are developed from the system weight data. The laws consider the implications of the major design parameters and mission requirements on the stage inert mass.
Author

N72-18779*# North American Rockwell Corp., Downey, Calif. Space Div.

IMPROVED SCALING LAWS FOR STAGE INERT MASS SPACE PROPULSION SYSTEMS. VOLUME 3: PROPULSION SYNTHESIS PROGRAM USERS AND PROGRAMMERS MANUAL

Jun. 1971 314 p refs
(Contract NAS2-6045)
(NASA-CR-114421; SD-71-534-3-Vol-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 21H

The analytical models developed for the Space Propulsion Automated Synthesis Modeling (SPASM) program are presented. Weight scaling laws developed during this study are incorporated into the program's scaling data bank. A detail listing, logic diagram and input/output formats are supplied for the SPASM program. Two test examples for one to four-stage vehicles performing different types of missions are shown to demonstrate the program's capability and versatility.
Author

N72-18780*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

DESIGN, FABRICATION, AND OPERATION OF DISHED ACCELERATOR GRIDS ON A 30-CM ION THRUSTER

V. K. Rawlin, B. A. Banks, and D. C. Byers 1972 19 p refs
Proposed for presentation at 9th Elec. Propulsion Conf., Washington, D. C., 17-19 Apr. 1972; sponsored by AIAA
(NASA-TM-X-68013; E-6796) Avail: NTIS CSCL 21C

Several closely-space dished accelerator grid systems were fabricated and tested on a 30-cm diameter mercury bombardment thruster and they appear to be a solution to the stringent requirements imposed by the near-term, high-thrust, low specific impulse electric propulsion missions. The grids were simultaneously hydroformed and then simultaneously stress relieved. The ion extraction capability and discharge chamber performance were studied as the total accelerating voltage, the ratio of net-to-total voltage, grid spacing, and dish direction were varied.
Author

N72-18781*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

A 30-CM DIAMETER BOMBARDMENT THRUSTER WITH A VARIABLE MAGNETIC BAFFLE

Robert T. Bechtel 1972 9 p refs Proposed for presentation at 9th Elec. Propulsion Conf., Washington, D. C., 17-19 Apr. 1972; sponsored by AIAA
(NASA-TM-X-68018; E-6817) Avail: NTIS CSCL 21C

Variable magnetic baffles were used to allow a change in baffle geometry to improve thruster performance and stability. Test results are presented. Thruster performance characteristics were analyzed to show how magnetic baffle field strength can improve performance at a fixed beam current, as well as increase the range of ion beam current for throttling.
Author

N72-18782*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

RESEARCH TRENDS IN TURBINE AERODYNAMICS

Warner L. Stewart and Arthur J. Glassman 1972 7 p
Presented at Gas Turbine and Fluids Eng. Conf. and Products Show, San Francisco, 26-29 Mar. 1972; sponsored by Am. Soc. of Mech. Eng.
(NASA-TM-X-68016; E-6814) Avail: NTIS CSCL 21E

Recent trends in turbine aerodynamics are summarized. Areas discussed include cooled turbine aerodynamics, high work factor turbines, pneumatic variable geometry, and computer analyses.
Author

N72-18783*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

GENENG: A PROGRAM FOR CALCULATING DESIGN AND OFF-DESIGN PERFORMANCE FOR TURBOJET AND TURBOFAN ENGINES

Robert W. Koenig and Laurence H. Fishbach Washington Feb.

1972 161 p
(NASA-TN-D-6552; E-5867) Avail: NTIS CSCL 21E

A computer program entitled GENENG employs component performance maps to perform analytical, steady state, engine cycle calculations. Through a scaling procedure, each of the component maps can be used to represent a family of maps (different design values of pressure ratios, efficiency, weight flow, etc.) Either convergent or convergent-divergent nozzles may be used. Included is a complete FORTRAN 4 listing of the program. Sample results and input explanations are shown for one-spool and two-spool turbojets and two-spool separate- and mixed-flow turbofans operating at design and off-design conditions. Author

N72-18784*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
GENENG 2: A PROGRAM FOR CALCULATING DESIGN AND OFF-DESIGN PERFORMANCE OF TWO- AND THREE-SPOOL TURBOFANS WITH AS MANY AS THREE NOZZLES
Laurence H. Fishbach and Robert W. Koenig Washington Feb. 1972 187 p refs
(NASA-TN-D-6553; E-6356) Avail: NTIS CSCL 21E

A computer program which calculates steady-state design and off-design jet engine performance for two- or three-spool turbofans with one, two, or three nozzles is described. Included in the report are complete FORTRAN 4 listings of the program with sample results for nine basic turbofan engines that can be calculated: (1) three-spool, three-stream engine; (2) two-spool, three-stream, boosted-fan engine; (3) two-spool, three-stream, supercharged-compressor engine; (4) three-spool, two-stream engine; (5) two-spool, two-stream engine; (6) three-spool, three-stream, aft-fan engine; (7) two-spool, three-stream, aft-fan engine; (8) two-spool, two-stream, aft-engine; and (9) three-spool, two-stream, aft-fan engine. The simulation of other engines by using logical variables built into the program is also described. Author

N72-18785*# National Aeronautics and Space Administration, Washington, D.C.
SOLID ROCKET MOTOR PERFORMANCE ANALYSIS AND PREDICTION Space Vehicle Design Criteria (Chemical Propulsion)
May 1971 113 p refs
(NASA-SP-8039) Avail: NTIS CSCL 21H

Current design practices are reviewed and assessed, and guidance is established for achieving greater consistency in design, reliability in the end product, and efficiency in the design effort. The total problem is discussed, and design elements involved in successful design are identified. Design criteria are described, and the rule, guide, limitation, or standard which must be imposed on each essential design element is given. Recommended practices are presented for satisfying each of the criteria. Author

N72-18786*# Boeing Co., Seattle, Wash.
TRANSONIC AND SUPERSONIC TEST OF A MACH 2.65 MIXED-COMPRESSION AXISYMMETRIC INTAKE
J. L. Koncsek and J. Syberg Washington NASA Mar. 1972 89 p
(Contract NAS2-6152)
(NASA-CR-1977) Avail: NTIS CSCL 21E

The test results describe isolated intake performance between Mach 0.95 and the cruise Mach number of 2.65 at angles of incidence from +5 to -5 deg. Maximum total pressure recoveries of over 94 percent with 10 percent distortion were recorded at the compressor face in the Mach range from 2.65 to 2.4. Typical cruise operating recovery was 91 percent with 13 percent distortion, 7 percent bleed, 5 percent corrected flow stability margin, and 2.2 deg angle-of-incidence tolerance without need for control action. In the started range below Mach 2.4, recoveries were 2 percent to 4 percent lower than the recoveries above Mach 2.4, and the distortion increased to approximately 20 percent. At Mach 0.95 the maximum measured capture flow was 99.4 percent of the theoretical choked value. The recovery was 97.1 percent with less than 10 percent distortion. Author

N72-18787# Ohio State Univ. Research Foundation, Columbus.
CONTAINMENT PROBLEMS IN ELECTRICAL AND NUCLEAR PROPULSION Final Report
S. N. B. Murthy Aug. 1971 130 p refs
(Contract F33615-67-C-1758; AF Proj. 7063)
(AD-733337; ARL-71-0126) Avail: NTIS CSCL 20/9

Containment is understood in the report as the process of confining a certain region of space from its adjoining regions with respect to the exchange of mass, momentum and energy. The measures of containment applicable to technological devices are established and discussed. In the field of propulsion, the development of electrothermal and electromagnetic thrustors, gas core nuclear reactor thrustors and fusion thrustors is examined here with respect to the containment problems involved therein. The major problems associated with any containment scheme are the incomplete interaction between the input mass flow and the applied fields, the occurrence of spurious losses and the setting of a variety of instabilities. In all of the thrustors under consideration, the possible use of a rotational velocity field (mechanically or electromagnetically induced) has lead to a variety of fluid dynamical and MHD simulation experiments. They are discussed in some detail in the report. The theoretical calculations which may be performed on containment are illustrated with a series of seven examples. One way of discussing the current status of containment problems is to examine the feasibility of scaling simple containment devices and such a discussion is presented from several points of view. Author (GRA)

N72-18788# Systems Control, Inc., Palo Alto, Calif.
A PRELIMINARY EVALUATION OF THRUST MAGNITUDE CONTROL FOR BOMBER DEFENSE MISSILES Final Report
David M. Salmon, Lewis Meier, and Stephen R. McReynolds Jul. 1971 55 p refs
(Contract F44620-71-C-0018)
(AD-731812; AFOSR-71-2458TR) Avail: NTIS CSCL 21/8

The findings are presented on a preliminary study to evaluate thrust magnitude control in Air Force missions in general and for bomber defense missiles in particular. The first two phases of the study, a survey of the application of optimal control theory to the analysis of thrust magnitude control and preparation of mathematical formulations for quantative analysis of specific applications, are reviewed. Then the techniques employed and results obtained in the third phase of the study analysis of horizontal rectilinear flight of a bomber defense missile, are described. Author (GRA)

N72-18789# Boeing Co., Renton, Wash. Airplane Div.
NACELLE COWLING OF HIGH BYPASS RATIO TURBOFAN ENGINES
Robert L. Lawrence 1971 39 p refs
(AD-733738; D6-18086TN) Avail: NTIS CSCL 21/5

Consideration of mission factors for subsonic transports has led to selection of high bypass turbofan engines. The proper integration of these engines with the airframe requires knowledge of the propulsive force supplied to the aircraft by the engines. The propulsive force may be determined by experimentally evaluating the thrust or drag of the various parts of the engine cowling, and synthesizing the nacelle drag by adding together the component drags. Accurate experimental results are difficult to obtain. The synthesis of component drags ignores interactions between components. Consequently analytical tools are being developed to calculate the drag and thrust. Suggested analysis techniques include incompressible and compressible inviscid and boundary layer flows. Advances in calculation techniques are needed for compressible flows, separated flows, and interference effects. Author (GRA)

N72-18790# Naval Scientific and Technical Intelligence Center, Washington, D.C. Translation Div.
AIR-COLLECTING AND GAS-WITHDRAWING DEVICES FOR NAVAL GAS TURBINE UNITS
Yu. A. Bordovitsyn, A. A. Vimba, N. Ya. Matusevich, and S. I. Nakhamkin 10 Dec. 1971 9 p Transl. into ENGLISH of "Vozdukhopriemnye i Gazootvodnye Ustroistva Sudovykh Gazoturbinnykh Ustanovok" Leningrad, Izd. Sudostr., 1969 p 83-91
(AD-733812; NAVSTIC-TRANS-3265) Avail: NTIS CSCL 20/1

In a number of cases the study of mufflers for the exhaust noise of powerful gas turbine units should be carried out on models. In this case, to transfer the results of model tests to real systems, it is necessary to observe certain conditions, both gas-dynamic and acoustic. Gas-dynamic similarity is necessary for correct evaluation of the hydraulic characteristics of mufflers and their effect on the basic parameters of gas turbine units. In view of the absence of information on the characteristics of mufflers which can be used for naval gas turbine units, a systematic study was conducted of various methods of reducing the noise level of naval gas turbine units on models of an exhaust system. Author (GRA)

N72-18791# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
THERMODYNAMIC AND BALLISTIC FUNDAMENTALS FOR DESIGNING ROCKET ENGINES USING SOLID PROPELLANTS (CHAPTER 5)
B. V. Orlov and G. Yu. Mazing 1 Nov. 1971 106 p refs Transl. into ENGLISH of "Termodinamicheskie i Ballisticheskie Osnovy Proektir. Raketnykh Dvigatelei na Tverdom Toplive" Moscow, Izd.-vo Mashinostr., 1968 p 334-455
(AF Proj. 6050)
(AD-734056; FTD-MT-24-936-71) Avail: NTIS CSCL 21/8

Ordinarily the problem of the interior ballistics of solid propellant rocket engines (SPRE) is solved in conformity with the monomial power law of fuel combustion. The suggested method permits one to find the process of change in pressure for any law of combustion of a ballistite or mixture fuel. When the SPRE reaches monomial mode there can be observed three clearly defined periods of functioning of the engine: autonomous combustion of the igniter; joint combustion of the igniter and fuel; and stabilization of pressure in the SPRE chamber.
Author (GRA)

29 SPACE RADIATION

Includes cosmic radiation; solar flares; solar radiation, and Van Allen radiation belts. For related information see also: 13 Geophysics; and 24 Physics, Atomic, Molecular, and Nuclear.

N72-18792*# Lockheed Missiles and Space Co., Palo Alto, Calif. Solar Observatory.
SPATIAL AND SPECTRAL STUDIES OF SOLAR PHENOMENA Final Report, Sep. 1970 - Aug. 1971
Karen L. Harvey, John L. Kulander, Sara F. Martin, and Harry E. Ramsey Sep 1971 49 p refs
(Contract NASw-2160)
(NASA-CR-125607; LMSC/D24368) Avail: NTIS CSCL 03B

Work proceeded simultaneously in four different areas of solar research. These were: (1) assembly and testing of the components of a multiple-slit H alpha spectrograph, (2) simultaneous observations of the wings of the H alpha line with a newly modified filter, (3) analysis of H alpha high resolution observations in conjunction with magnetic field observations obtained at Kitt Peak, and (4) theoretical analysis of the D3 line HeI. Author

N72-18793# Academy of Sciences (USSR), Moscow.
ULTRARELATIVISTIC COSMIC PLASMA
Yu. P. Ochelkov, O. F. Prilutskiy, I. L. Rozental, and I. B. Shukalov 1971 37 p refs In RUSSIAN
(PR-51) Avail: NTIS

The penetration of streams of highly energetic electrons in strong magnetic fields is considered. Nonlinear electron interaction with photons and the various forms of elementary processes occurring are discussed. Transfer equations for photons and high energy electrons were established, taking induction processes into account. These equations, which describe the nonequilibrium state of particle distribution, are solved for several limiting cases. The influence of nonlinear interactions on the formation of photon and electron energy spectra is also considered. The conditions of formation for stationary and equilibrium states were investigated, and the principal questions of thermodynamic equilibrium under ultrarelativistic temperature conditions are reviewed. The conditions for hydrodynamically describing an ultrarelativistic plasma and the possibility of solving problems in this area are discussed. Transl. by K.P.D.

N72-18794# Smithsonian Astrophysical Observatory, Cambridge, Mass.
ATMOSPHERIC FLUORESCENCE AS A GROUND-BASED METHOD OF DETECTING COSMIC X-RAYS Ph.D. Thesis - Harvard Univ.
James L. Elliot 24 Jan. 1972 160 p refs
(SAO-Special-Rept-341; SAO-111-039) Avail: NTIS

The possibility was investigated for detecting only X-ray sources whose flux varies on a time scale of one second or shorter. The sensitivity of the fluorescence technique is limited by the shot noise of the night sky background light. A station to detect atmospheric fluorescence caused by cosmic X-rays was set up at Agassiz Station, Massachusetts and then moved to Mt. Hopkins, Arizona. A study of light pulses that might be confused with fluorescence was made. The sources of background pulsed that were studied are meteor trails, stellar scintillations, manmade light, lightning, the xenon flashlamp, and Cerenkov light from air showers. It was concluded that the fluorescence technique is well suited for searching for energetic, but infrequent, pulses of X-rays, and improved techniques are suggested. Author

N72-18795*# Michigan Univ., Ann Arbor. Dept. of Astronomy.
ANALYSIS OF SOLAR X-RAY DATA Final Report
Richard G. Teske Jan. 1972 68 p refs
(Grant NGR-23-005-367; ORA Proj. 034590)
(NASA-CR-125600; Rept-034590-1-F) Avail: NTIS CSCL 03B

Type III solar bursts occurring in the absence of solar flares were observed to be accompanied by weak X-radiation. The energy scale of an OSO-3 soft X-ray ion chamber was assessed using realistic theoretical X-ray spectra. Relationships between soft solar X-rays and solar activity were investigated. These included optical studies, the role of the Type III acceleration mechanism in establishing the soft X-ray source volume, H alpha flare intensity variations, and gross magnetic field structure.
K.P.D.

N72-18796*# Bellcomm, Inc., Washington, D.C.
INTERACTION OF THE SOLAR WIND WITH A PLANETARY IONOSPHERE
J. L. Blank and W. R. Sill 25 Jan. 1972 37 p refs
(Contract NASw-417)
(NASA-CR-125673; TM-72-2015-1) Avail: NTIS CSCL 03B

An electrodynamic model for an ionosphere-solar wind interaction is developed based on the existence of a low beta plasma below the anemopause. The currents for the interaction are driven by the solar wind motional electric field and induce a stagnation magnetic field at the anemopause. For Venus and Mars the lower region of the ionosphere near the electron density peak has the highest conductivity, and therefore the tangential component of the induction current flows substantially in this region. The current paths close in the anemopause, which is a solar wind current sheath analogous to the magnetopause.

Both the fraction of the undisturbed solar wind motional electric field, which drives the induction current, and the required fraction of incident solar wind particles, crossing the anemopause to produce this current, are shown to be small. Author

N72-18797*# National Aeronautics and Space Administration. Manned Spacecraft Center, Langley Station, Va.
RADIATION DOSIMETRY FOR THE GEMINI PROGRAM
Robert G. Richmond Washington Mar. 1972 16 p refs
(NASA-TN-D-6695; MSC-S-222) Avail: NTIS CSCL 03B

The principal source of radiation for low-earth-orbit, low inclination space flights is in the area of the South Atlantic magnetic anomaly. None of the Gemini dose measurements reported in the paper are of high enough intensity to be considered hazardous. There is a trend toward larger doses as missions are flown higher and longer. Extended orbital operations between 1400 and 4400 kilometers would encounter high interior radiation levels. Pronounced spacecraft geometry effects have been measured in manned spacecraft. Instrumentation for radiation measurements on Gemini spacecraft is described. Author

N72-18798*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
SOME CHARACTERISTICS OF MICROWAVE TYPE 4 RADIO BURSTS AND THE ACCELERATION OF SOLAR COSMIC RAYS
Kunitomo Sakurai Feb. 1972 10 p refs
(NASA-TM-X-65833; X-693-72-45) Avail: NTIS CSCL 03B

The relationships between some characteristics of microwave type 4 radio bursts and solar cosmic ray protons of MeV energy are discussed. It is shown that the peak flux intensity of those bursts is almost linearly correlated with the MeV proton peak flux observed by satellites near the earth. The rise times of type 4 microwave emissions are, however, independent of the proton peak fluxes. Using these results, discussion is given on the acceleration process and duration for both protons and electrons. Author

N72-18799# Danish Space Research Inst., Lyngby.
ISOTOPIC COMPOSITION OF THE PRIMARY COSMIC RADIATION
Philip M. Dauber, ed. Aug. 1971 295 p Proc. of a Symp. held in Lyngby, Den., Mar. 1971
Avail: NTIS

Results and findings of primary cosmic ray isotopic composition, origin, spallation reactions, and diffusion in space are presented. Values obtained from experimental results and from theory are compared; various mechanisms are reported. For individual titles, see N72-18800 through N72-18818.

N72-18800# New Hampshire Univ., Durham. Dept. of Physics.
RECENT MEASUREMENTS OF CHARGE AND ISOTOPE COMPOSITION USING COUNTERS
W. R. Webber *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 12-38 (See N72-18799 09-29)
Avail: NTIS

Measurements of the charge and isotopic composition of cosmic ray nuclei, their limitations, and potential for future development are discussed. Some recent experimental results are presented on the charge and isotopic composition of the light nuclei, Li, Be, and B, and on the charge composition in the charge number range from 15 to 30. ESRO

N72-18801# Danish Space Research Inst., Lyngby.
ISOTOPE EXPERIMENTS USING THE GEOMAGNETIC FIELD
N. Lund *In its* Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 39-52 refs (See N72-18799 09-29)
Avail: NTIS

Based on using the geomagnetic field for obtaining information on the isotopic composition of cosmic rays, the geomagnetic field effect on the particle fluxes is discussed. It is shown that an exact knowledge of local geomagnetic cut-offs is not needed for the experiments. The finite velocity resolution of the counters to be used is taken into account, and limitations are imposed on the results. It is concluded that it is possible to obtain accurate results on the relative charge to mass ratios for the elements in primary cosmic rays using the earth's magnetic field. ESRO

N72-18802# Danish Space Research Inst., Lyngby.
RECENT RESULTS ON CHEMICAL AND ISOTOPIC COMPOSITION IN THE HIGH ENERGY REGION
S. N. Tandon *In* Its Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 53-62 refs (See N72-18799 09-29)
Avail: NTIS

The results are discussed from a series of balloon flights made from France during 1970 to investigate the charge composition and the isotopic abundance in near relativistic cosmic ray nuclei. It was found that the abundance of nuclei in the charge range from 20 to 25 is much lower than was reported by earlier works. ESRO

N72-18803# California Univ., Berkeley.
THE STUDY OF ISOTOPES OF HEAVY COSMIC RAY NUCLEI BY MEANS OF TRACKS IN PLASTICS
P. B. Price *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 63-77 refs (See N72-18799 09-29)
Avail: NTIS

A technique to identify individual isotopes in cosmic radiation by the measurement of etch pits in plastic sheets onboard satellites is described. Experiments using cellulose nitrate in accelerator beams showed that it was possible to differentiate between B-10 and B-11. The results of balloon flight experiments using Lexan and cellulose triacetate plastics were compared with nuclear emulsion, and no systematic variation was apparent over the range of atomic number 40 to 100. Two events estimated by the nuclear emulsion technique to be heavier than uranium are noted. A result in conflict with long life for cosmic rays was the relatively small amount of lead found. ESRO

N72-18804# Lund Univ. (Sweden). Dept. of Physics.
ISOTOPE ANALYSIS WITH NUCLEAR EMULSIONS
K. Kristiansson *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 79-88 refs (See N72-18799 09-29)
Avail: NTIS

The mass resolution which can be expected in measurements of cosmic ray heavy particles with a clear emulsion is discussed. Error estimates were based on accurate measurements with nuclear track photometers of the relation between track width and residual range in tracks of beryllium, carbon, oxygen, neon, magnesium, and iron. It was found that satisfactory isotope resolution could be reached for nuclei in the charge region 3 to 8; the error in mass determination being less than 1/2 atomic mass unit. The error in the charge region 10 to 16 was approximately 1/2 atomic mass unit. Accuracy was insufficient for isotope analyses in the iron region. ESRO

N72-18805# Danish Space Research Inst., Lyngby.
ISOTOPE ANALYSIS WITH THE HELP OF A CRYOGENIC MAGNET
P. M. Dauber *In* Its Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 89-97 (See N72-18799 09-29)
Avail: NTIS

Individual cosmic ray nuclei can be identified isotopically using a magnetic spectrometer in conjunction with counters. A specific experimental design using a cryogenic magnet and scintillation counters to measure the charge composition and rigidity of the cosmic ray nuclei is described. The error analysis is discussed and applied to Be-9, Be-10, and other light element separations. It is concluded that elements much above oxygen including iron, could only be separated isotopically by this method if the spectrometer resolution were substantially improved. ESRO

N72-18806# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

THE HEAO SATELLITE PROPOSAL ON CHEMICAL AND ISOTOPIC COMPOSITION OF PRIMARY COSMIC RAYS

L. Koch *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 99-116 (See N72-18799 09-29)

Avail: NTIS

The galactic cosmic radiation is determined in the rigidity interval from 4 to 15 GeV including: (1) the flux and energy spectrum of elements between beryllium and tin; and (2) the isotopic composition of the abundant elements from beryllium to iron in the rigidity interval which corresponds to 1.5 to 7 GeV per nucleon. The experimental design is discussed including four Cerenkov counters measuring the charge and velocity of particles and two spark chambers. Ground and in-flight calibration of the instrument is discussed, and the probable performance on the proposed satellite orbit is explored. ESRO

N72-18807# Centre National de la Recherche Scientifique, Paris (France). Centre de Spectrometrie Nucleaire.

EXPERIMENTAL DETERMINATION OF PROTON AND ALPHA PARTICLE INDUCED SPALLATION CROSS-SECTIONS IN OXYGEN, CARBON AND BORON c24

F. Yiou *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 118-133 refs (See N72-18799 09-29)

Avail: NTIS

In order to obtain the isotopic composition of the elements Li, Be, and B in galactic cosmic rays, a complete set of nuclear cross-section was measured by mass spectrometry during the high energy proton and high energy alpha irradiation of carbon 12, oxygen 16, and boron targets. The tertiary origin of Be-10 in B-11 (p, 2p)Be-10 reactions was shown. ESRO

N72-18808# Centre National de la Recherche Scientifique, Paris (France). Centre de Spectrometrie Nucleaire.

SOME RESULTS ON CROSS SECTION MEASUREMENTS IN THE LOW ENERGY RANGE

M. Epherre *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 135-137 refs (See N72-18799 09-29)

Avail: NTIS

Cross sections measured for nuclear reactions induced by protons of energy lower than 50 MeV on nitrogen-14 and oxygen-16 are given. ESRO

N72-18809# Centre National de la Recherche Scientifique, Paris (France). Centre de Spectrometrie Nucleaire.

Be-7 AND OTHER ELECTRON CAPTURE ISOTOPES IN COSMIC RAYS

G. Raisbeck *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 139-146 refs (See N72-18799 09-29)

Avail: NTIS

In order to obtain more information on the possible destruction of Be-7 by atomic electron capture followed by nuclear decay in the interstellar medium, a series of experiments measuring the atomic electron capture and half cross sections was carried out. Proton irradiation results of Mylar, Al, Ni, and Te targets at energies higher than 40, 155, and 600 MeV are reported. ESRO

N72-18810# Institut d'Astrophysique, Paris (France).

THE PRODUCTION OF THE ELEMENTS Li Be B BY GALACTIC COSMIC RAYS IN SPACE

M. Meneguzzi, J. Audouze, and H. Reeves *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 147-156 refs (See N72-18799 09-29)

Avail: NTIS

Continuous bombardment of the interstellar gas by galactic cosmic rays generates Li, Be, and B nuclei by nuclear spallation reactions which are eventually observed in stars and in the solar system. This scheme is briefly developed. ESRO

N72-18811# Institut d'Astrophysique, Paris (France).

THE BERYLLIUM ISOTOPIC COMPOSITION IN COSMIC RAYS

M. Meneguzzi, J. Audouze, and H. Reeves *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 157-160 refs (See N72-18799 09-29)

Avail: NTIS

The beryllium isotopic composition in galactic cosmic rays was investigated, using the Reeves calculation. Beryllium-7 was found to be the dominant isotope. The Be-7/Be ratio gave a value of 0.75 in the range from 100 to 200 MeV/nucleon and is in agreement with experimental values. Discrepancies were observed between the calculated and experimental curves representing the Be/(Li + B) fluxes ratio as a function of energy. ESRO

N72-18812# Institut d'Astrophysique, Paris (France).

NITROGEN IN COSMIC RAY SOURCES

M. Meneguzzi, J. Audouze, and H. Reeves *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 161-168 refs (See N72-18799 09-29)

Avail: NTIS

In order to investigate the origin of cosmic ray nitrogen particles, the results of different processes such as hydrogen burning through CNO cycle, helium burning, and simple ejection from normal stars are shown and compared with galactic cosmic ray flux ratios in space or at the sources. Spallation cross sections for proton induced O-16, and C-12 are plotted vs energy, and the results obtained are discussed. ESRO

N72-18813# Institut d'Astrophysique, Paris (France).

POSSIBLE EFFECTS OF INTENSE LOW ENERGY COSMIC RAY FLUXES

M. Meneguzzi, J. Audouze, and H. Reeves *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 169-171 refs (See N72-18799 09-29)

Avail: NTIS

The galactic cosmic ray fluxes (with source spectra shaped as a power law in total energy) account for galactic cosmic ray isotopic ratios, energies less than or equal to some 100 MeV/nucleon, and abundance of L elements in the solar system and some F and G stars. In order to explain the heating of H 1 regions and the lithium-7 overabundance in many F stars and in the solar system, a model is described adding a low energy component to the total energy power law source spectrum. ESRO

N72-18814# Leiden Univ. (Netherlands). Kammerlingh Onnes Lab.

SOME RELATIONS BETWEEN ELECTRONS, POSITRONS AND THE ISOTOPIC COMPOSITION IN INTERSTELLAR SPACE

J. J. Burger *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 173-202 refs (See N72-18799 09-29)

Avail: NTIS

The different links between the study of the cosmic ray electron component through its radio emission and isotopic composition are shown. However a comparison and improved future observations at both sides is necessary for understanding the cosmic ray origin and propagation. ESRO

N72-18815*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THE EFFECTS OF PROPAGATION AND SOURCE DISTRIBUTION ON COSMIC RAY COMPOSITION AND ANISOTROPY

R. Ramaty and R. E. Lingenfelter (Calif. Univ., Los Angeles) *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 203-233 refs (See N72-18799 09-29)
(NASA-TM-X-67538) Avail: NTIS CSCL 03B

The propagation and source distribution of cosmic rays are considered. The principal requirement for the various models is that they should be capable of holding particles in dense regions of the galactic disk for time periods sufficient to produce the observed fragmentation products of cosmic rays. This can be achieved by both simple and compound diffusion provided that suitable mean free paths and boundary conditions are chosen. The bulk of the anisotropy is caused by the discrete nature of the cosmic ray sources. Models which reproduce the fragmentation products yield anisotropies consistent with available upper limits. Author (ESRO)

N72-18816# Commissariat a l'Energie Atomique, Saclay (France). Centre d'Etudes Nucleaires.

INTERPLANETARY DECELERATION AND THE SIGNIFICANCE OF THE OBSERVED COSMIC RAY DEUTERON AND He-3 FLUXES

Jean-Paul Meyer *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 235-246 refs (See N72-18799 09-29)
Avail: NTIS

The cosmic ray low-energy deuteron and helium-3 formation mechanisms and propagation in the interstellar space are discussed. The adiabatic deceleration in the solar cavity due to the solar activity effects is explained. ESRO

N72-18817*# Yeshiva Univ., New York. Belfer Graduate School of Science.

SUPERNOVA EXPLOSIONS

A. G. W. Cameron *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 248-278 refs Sponsored in part by NASA, AEC and NSF (See N72-18799 09-29)
(NASA-CR-125379) Avail: NTIS CSCL 03B

The chemical evolution of the galaxy is reviewed including the quantitative reproduction of the relative abundances in the solar system of different processes of nucleosynthesis, the gas content, the supernova activity rate galactic in the galaxy, and the chronology of the radioactive elements in the solar system. The formation of the light elements by the cosmic rays in the interstellar medium is described. ESRO

N72-18818*# National Aeronautics and Space Administration. Goddard Inst. for Space Studies, New York.

THE ROLE OF NEUTRON STARS IN THE ACCELERATION OF COSMIC RAYS

A. G. W. Cameron (Yeshiva Univ.) *In* Danish Space Res. Inst. Isotopic Composition of the Primary Cosmic Radiation Aug. 1971 p 279-294 refs Sponsored in part by AEC, and NSF (See N72-18799 09-29)
(NASA-TM-X-67539) Avail: NTIS CSCL 03B

The possibilities that neutron stars may be involved in the acceleration of cosmic rays are evaluated. Two possible mechanisms are described. In the first, the material is accelerated from the surface of the neutron star; in the second, the material may be accelerated in an electromagnetic wave interaction with the supernova ejected material. It is concluded that neutron stars may be effective in accelerating helium and iron to the highest cosmic ray energies, and that at lower energies they may accelerate supernova debris into the cosmic ray fluxes throughout the galaxy. ESRO

N72-18819# Environmental Research and Technology, Inc., Lexington, Mass.

FEASIBILITY STUDY FOR A PROSPECT HILL INTERFEROMETER Final Report, Jan. - Oct. 1971

Edward C. Reifenstein, III and George D. Papadopoulos 11 Oct. 1971 147 p refs
(Contract F19628-71-C-0108; AF Proj. 8682)
(AD-733707; AFCRL-71-0459) Avail: NTIS CSCL 03/2

High resolution millimeter-wave studies of the spatial distribution of brightness within solar active regions provide the means whereby mechanisms for the generation of flare-related radio bursts may be explored. This report examines the feasibility of coupling the existing AFCRL 29-foot millimeter-wave antenna located at Prospect Hill, Waltham, Massachusetts with one or more smaller antennas in order to produce a system capable of operating as a solar interferometer. The configuration studied provides a single fixed baseline of 4433 lambda at the operating wavelength of 8.6 mm, with a minimum fringe spacing of 45 arc-seconds. Theoretical aspects of radio interferometry are reviewed for the present application, and the fundamental limitations of the system are examined. It is found that scale-size and position estimates of single-source distributions may be readily obtained, and that certain multiple source distributions may be studied using model-fitting procedures. Author (GRA)

N72-18254# Academy of Sciences (USSR), Moscow.

STUDY OF COSMIC RAYS

S. N. Vernov, G. P. Lyubimov, Ye. A. Chuchkov, and N. N. Kontor *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 116-125 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

30 SPACE SCIENCES

Includes astronomy and astrophysics; cosmology; lunar and planetary flight and exploration; and theoretical analysis of orbit and trajectory. For related information see also: 11 Facilities, Research and Support; and 31 Space Vehicles.

N72-18820*+ National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

ATLAS AND GAZETTEER OF THE NEAR SIDE OF THE MOON

Gary L. Gutschewski, Danny C. Kinsler, and Ewen Whitaker Washington 1971 539 p refs
(NASA-SP-241; LC-73-607342) Avail: NTIS; SOD $15.00 CSCL 03B

The atlas contains 404 annotated Lunar Orbiter 4 photographs of the near side of the moon. A short history of lunar nomenclature and a gazetteer of five indices are also included. N.E.N.

N72-18821+ National Center for Atmospheric Research, Boulder, Colo.

SIZE DISTRIBUTIONS OF MAGNETIC SPHEROIDS

J. Rosinski Nov. 1971 66 p refs Sponsored by NSF
(NCAR-TN/STR-71) Avail: NTIS

Concentration peaks for magnetic spheroids were recorded simultaneously at various latitudes in the Northern and Southern Hemispheres for the period 1 to 16 October in 1967 and 1969. Size distributions are given for October 1969, and the data are presented for those days on which spheroid concentration counts exceeded 100 particles/1,000 cu m. The computer listings are arranged to show size distributions of spherules and oblong spheroids by 1-micron increments from 2- to 20-micron diameter; partial data for spheroids in the 20- to 30-micron range are included. Ratios for 2 to 3, 3 to 5, and 2 to 5 micron per 5- to 20-micron diameter spheroids are also given. Author

N72-18822# Academy of Sciences (USSR), Moscow.
GASEOUS EJECTION IN NGC 4486 AND PROBLEM OF GALACTIC NUCLEI ACTIVITY
I. S. Shklovski 1971 26 p refs In RUSSIAN; ENGLISH summary
(NP-76) Avail: NTIS

The question about the nature of counter ejection and fan-shaped ejection in NGC 4486 is discussed. Evolution of planetary nebulae generated in NGC 4486 with small specific momentum (about three solar masses per year) is considered. The hypothesis is suggested that X-ray sources in NGC 4486 may be thermal ones fed by accretion. Author

N72-18823# Thessaloniki Univ. (Greece). Div. of Rural and Surveying Engineering.
COMPUTATION OF HIGH PRECISION POLE STAR TABLES M.S. Thesis
Ioannes B. Trantides 1969 75 p refs In GREEK
Avail: NTIS

The theoretical and programming considerations for preparing the Pole Star tables are presented. The azimuth of an object and the geodetic latitude of the observer are determined by referring to the pole star. The mathematical relationships used for finding the constants are obtained by solving for the spherical triangle formed by the north celestial pole, the zenith of the observation point, and the zenith of the star. The azimuth of an object is also determined from the altitude or the hour angle of a star or the sun. The formulation of four computer programs of azimuth determination are presented in detail. Author

N72-18824*# Lockheed Missiles and Space Co., Palo Alto, Calif. Research Labs.
ROCKET STUDY OF THE X-RAY BACKGROUND Final Report
Philip C. Fisher, Richard C. Catura, Paul Kirkpatrick, Arthur J. Meyerott, and Douglas T. Roethig 31 Dec. 1971 47 p refs
(Contract NASw-1388)
(NASA-CR-125598; LMSC/D246734) Avail: NTIS CSCL 03A

The X-ray optical detection system flown on Aerobee 17.08 is described in detail, and the preliminary results of the 24 June 1971 flight are discussed. The optical design, fabrication and parabolic nature of the mirrors, effective aperture of mirror array, and X-ray detectors are considered. Preliminary analysis of data from the flight confirms the extended nature and complex structure of the X-ray source in Virgo. A core of X-ray emission is indicated which is approximately 0.5 deg in diameter and surrounded by an emitting region at least 2 deg across. The Virgo source spectrum is observed to have few low energy photons. N.E.N.

N72-18825*# Northwestern Univ., Evanston, Ill. Dept. of Astronomy.
ENVELOPES IN ECLIPSING BINARY STARS
Su-Shu Huang [1972] 42 p refs
(Grant NGL-14-007-041)
(NASA-CR-125630) Avail: NTIS CSCL 03A

Theoretical research on eclipsing binaries is presented. The specific areas of investigation are the following: (1) the relevance of envelopes to the study of the light curves of eclipsing binaries, (2) the disk envelope, and (3) the spherical envelope. Author

N72-18826*# Lunar Science Inst., Houston, Tex.
LUNAR SCIENCE. 3: REVISED ABSTRACTS OF PAPERS PRESENTED AT THE THIRD LUNAR SCIENCE CONFERENCE
Carolyn Watkins, ed. Jan. 1972 835 p refs Conf. held at Houston, Tex., 10-13 Jan. 1972
(Contract NSR-09-051-001)
(NASA-CR-125605; LC-79-189790; Contrib-88) Avail: NTIS CSCL 03B

Prior to the meeting some 375 preliminary abstracts were printed for distribution to conference participants, with the provision that revised abstracts of up to three typed pages each could be submitted before the end of the conference. These updated expanded abstracts are collected here. Author

N72-18827*# Israel Program for Scientific Translations, Ltd., Jerusalem.
INTERPLANETARY FLIGHT AND COMMUNICATION, VOLUME 1, NO. 3: RADIANT ENERGY, SCIENCE FICTION AND SCIENTIFIC PROJECTS
N. A. Rynin 1971 138 p refs Transl. into ENGLISH of the book "Mezhplanetnye Soobshcheniya. Volume 1, no. 3: Luchistaya Energiya v Fantaziyakh Romanistov i v Proektakh Uchenykh" Lenigrad, 1931 Sponsored by NASA and NSF
(NASA-TT-F-642; TT-70-50113) Avail: NTIS CSCL 20E

Ideas on the generation and action of powerful new rays, mainly from science fiction, are presented, and the 1930 status of science on these subjects in summarized. The areas of discussion are the following: radiant energy in science fiction and scientific projects; interplanetary signals and communication in science, including optical and radio communication; interplanetary signals in scientific projects; changing the motion of the earth and other planets by artificial means in science fiction; and when man reaches other planets, including over population of the earth, earth resources, energy balance, forced emigration, and the end of the world. N.E.N.

N72-18828*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.
A MONTE CARLO ERROR ANALYSIS PROGRAM FOR NEAR-MARS, FINITE-BURN, ORBITAL TRANSFER MANEUVERS
Richard N. Green, Lawrence H. Hoffman, and George R. Young Washington Feb. 1972 70 p refs
(NASA-TN-D-6598; L-7978) Avail: NTIS CSCL 22A

A computer program was developed which performs an error analysis of a minimum-fuel, finite-thrust, transfer maneuver between two Keplerian orbits in the vicinity of Mars. The method of analysis is the Monte Carlo approach where each off-nominal initial orbit is targeted to the desired final orbit. The errors in the initial orbit are described by two covariance matrices of state deviations and tracking errors. The function of the program is to relate these errors to the resulting errors in the final orbit. The equations of motion for the transfer trajectory are those of a spacecraft maneuvering with constant thrust and mass-flow rate in the neighborhood of a single body. The thrust vector is allowed to rotate in a plane with a constant pitch rate. The transfer trajectory is characterized by six control parameters and the final orbit is defined, or partially defined, by the desired target parameters. The program is applicable to the deboost maneuver (hyperbola to ellipse), orbital trim maneuver (ellipse to ellipse), fly-by maneuver (hyperbola to hyperbola), escape maneuvers (ellipse to hyperbola), and deorbit maneuver. Author

N72-18829*# Translation Consultants, Ltd., Arlington, Va.
CONTEMPORARY IDEAS ABOUT THE ATMOSPHERE OF VENUS
V. N. Konashenok Washington NASA Feb. 1972 31 p refs Transl. into ENGLISH from the book "Novoye o Venere i Marse" Leningrad, Gidrometeorologicheskoye Press, 1970 p 3-27
(Contract NASw-2038)
(NASA-TT-F-692) Avail: NTIS CSCL 03B

The methods and the results of the Venus atmospheric research with the help of spacecrafts, Venera-4, Venera-5, Venera-6 and Mariner-5 are described and chief results of recent ground observations are given. Various experimental results are compared and analyzed from the point of view of the presence of the discrepancies. The principal problems associated with the theoretical interpretation of the given observations, as well as with the modeling of the upper and lower atmosphere, are dealt with. Author

N72-18830*# Ohio State Univ. Research Foundation, Columbus. Dept. of Geodetic Science.

AN INVESTIGATION TO IMPROVE SELENODETIC CONTROL THROUGH SURFACE AND ORBITAL LUNAR PHOTOGRAPHY Interim Report

Harry Jauncey Sweet, III Sep. 1970 58 p refs
(Contract NAS9-9695; OSURF Proj. 2841)
(NASA-CR-125613; Rept-144; IR-3) Avail: NTIS CSCL 03A

The use of lunar surface photography to achieve the photogrammetric transfer of available selenographic coordinates from future lunar landing sites to neighboring, photoidentifiable features was investigated. It can be implied from the procedures developed that overhead photography, were it available, could be utilized and would provide a material strengthening of the total solution. By the methodic selection of features and confirmation that they can in reality be identified from orbital photography, a modest selenodetic control system can be expanded into a net that could ultimately control all future, manned or unmanned, orbital photographic missions. Author

N72-18831*# National Aeronautics and Space Administration, Washington, D.C.

PIONEER F MISSION TO JUPITER

Howard G. Allaway and Peter W. Waller 20 Feb. 1972 6 p
(NASA-News-Release-72-25) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22A

The experimental designs for the Pioneer F mission to Jupiter are described. The spacecraft is designed to make measurements of the planet's atmosphere, radiation belts, heat balance, magnetic fields, moons, and other related phenomena. The mission also characterizes the heliosphere, the interstellar gas, cosmic rays, asteroids, and meteoroids between the earth and 2.4 billion kilometers from the sun. E.H.W

N72-18832# Joint Publications Research Service, Washington, D.C.

SOVIET-BLOC RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 270

14 Feb. 1972 96 p refs Transl. into ENGLISH from RUSSIAN reports
(JPRS-55179) Avail: NTIS

Translations and abstracts are presented of articles on meteorology, oceanography, upper atmosphere and space research, astronomy and terrestrial geophysics, covering both science news and formal scientific reports. Published details of Soviet space spectaculars are included. Author

N72-18833*# National Aeronautics and Space Administration, Washington, D.C.

TD-1A: PRESS KIT

Howard G. Allaway and Kenneth Senstad 3 Mar. 1972 13 p
(NASA-News-Release-72-43) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 22C

The scientific experiments onboard the Thor-Delta 1Z spacecraft are described. The experiments were designed to study high energy emissions from stellar and galactic sources and the Sun not visible to earth bound observations. Studies were also made of the ultraviolet radiation, X-rays, gamma rays unhindered by the blanketing and absorbing effect of the earth's atmosphere. E.H.W.

N72-18834*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

VLBI CLOCK SYNCHRONIZATION TESTS PERFORMED VIA THE ATS-1 AND ATS-3 SATELLITES

J. Ramasastry, B. Rosenbaum, R. D. Michelini (Smithsonian Astrophys. Obs.), and G. Kuegler (Westinghouse Elec. Corp.) Dec. 1971 16 p ref
(NASA-TM-X-65818; X-553-71-514) Avail: NTIS CSCL 22B

Clock synchronization experiments were carried out May 10 to June 10, 1971, by the NASA/Goddard Space Flight Center and the Smithsonian Astrophysical Observatory via the ATS-1 and 3 geostationary satellites at the NASA tracking stations Rosman and Mojave, during a VLBI (Very Long Baseline Interferometer) experiment in order to determine the clock-offset between the two stations. Ten microsecond pulses at C-band with very sharp risetime were exchanged by the two stations through the dual transponders of the satellites. At each station, a time-interval counter was started by the transmitted pulse and stopped by the received pulse. The probable error of the difference in the mean values of the clock-offset is 10 nanoseconds. Author

N72-18835*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

THERMAL ELASTIC DEFORMATIONS OF THE PLANET MERCURY

Han-Shou Liu Dec. 1971 10 p refs Submitted for publication
(NASA-TM-X-65817; X-553-71-506) Avail: NTIS CSCL 03B

The variation in solar heating due to the resonance rotation of Mercury produces periodic elastic deformations on the surface of the planet. The thermal stress and strain fields under Mercury's surface are calculated after certain simplifications. It is shown that deformations penetrate to a greater depth than the variation of solar heating, and that the thermal strain on the surface of the planet pulsates with an amplitude of 0.004 and a period of 176 days. Author

N72-18836# Academy of Sciences (USSR), Moscow.

THE KADR PROGRAM FOR CALCULATING GEOGRAPHIC, GEOPHYSICAL, AND ASTRONOMICAL COORDINATES AND OTHER CHARACTERISTIC POINTS ALONG A SATELLITE TRAJECTORY

Yu. N. Ponomarev and Yu. I. Galperin 1971 64 p refs In RUSSIAN
(PR-70) Avail: NTIS

The general program is described for calculating navigational data and for analyzing data from Cosmos and Elektron experiments. The structure and computational elements are of the computer program given for determining (1) geographical coordinates; (2) invariant coordinates; (3) geomagnetic parameters; (4) an absolute coordinate system, Sun direction, and local time variants; (5) geomagnetic time (central dipole); (6) auroral (eccentric) longitude; (7) auroral time calculated along the auroral longitude; (8) the angle between the vectors B and S (solar); (9) components of the velocity vector in the horizontal (geomagnetic coordinate system); (10) dip and declination of the velocity vector in the geomagnetic system; (11) angles of vector V with absolute coordinate system axes; and characteristics of the magnetic conjugate point. A program printout is presented. Transl. by K.P.D.

N72-18837# Academy of Sciences (USSR), Moscow.

POSSIBILITY OF USING RADIOLOCATION AND RADIOMETRIC SYSTEMS FOR INVESTIGATIONS OF THE EARTH, MOON, AND PLANETS

N. N. Krupenio, O. F. Shakhno, and V. S. Etkin 1971 44 p refs In RUSSIAN
(PR-54) Avail: NTIS

A combined system is considered which permits simultaneous radiolocation and radiometric study of local regions on planetary surfaces. Operating procedures of the artificial satellite system are discussed for several orbit parameter variants and a number of antenna aperture dimensions. Transl. by K.P.D.

N72-18838*# Michigan Univ., Ann Arbor. Radio Astronomy Observatory.

INSTRUMENTATION FOR RADIO ASTRONOMY MEASUREMENTS ABOARD THE IMP-I SPACECRAFT Final Engineering Report, May 1969 - Mar. 1971

Fred T. Haddock 1 Jun. 1971 80 p refs
(Contract NAS5-11174)

(NASA-CR-122350; UM/RAO-71-5) Avail: NTIS CSCL 03A

The design considerations and performance parameters of a satellite-borne instrumentation system are discussed. The system is designed to make radio astronomy measurements at eight discrete frequencies from 50 kHz to 3.53 MHz. These measurements are to detect solar and Jovian radio frequency bursts and to determine the average cosmic background radiation level down to 50 kHz. Procedures used for preflight and inflight calibration of the radiometer and the ground support equipment used for preflight testing are described. Author

N72-18839# Smithsonian Astrophysical Observatory, Cambridge, Mass.

COLOR-MAGNITUDE DIAGRAMS OF FIVE FAINT CLUSTERS OF THE LARGE MAGELLANIC CLOUD

Paul W. Hodge 24 Aug. 1971 23 p refs

(Grant NSF GP-16581)

(SAO-Special-Rept-337) Avail: NTIS

Color-magnitude diagrams of five faint clusters in the Large Magellanic Cloud are obtained by astrophotometry of ADH Schmidt plates centered on three faint photoelectric sequences. Two of the clusters are old, with well-established giant branches that are at least 2 mag brighter than their main sequences, while the other three are young, with bright, sparsely populated main sequences and several giant members. Author

N72-18840*# Translation Consultants, Ltd., Arlington, Va.

LIDARING THE MOON

Yu. L. Kokurin Washington NASA Feb. 1972 11 p Transl. into ENGLISH from Priroda (USSR), no. 10, Oct. 1971 p 42-46

(Contract NASw-2038)

(NASA-TT-F-14116) Avail: NTIS CSCL 03A

The use of lidaring to determine the distance to the moon is discussed and compared with earlier attempts in terms of complexity and accuracy. The use of the reflector installed on Lunokhok 1 in conjunction with laser equipment developed in the Soviet Union is described. Shortcomings in present arrangements are pointed out. Author

N72-18841*# Cornell Univ., Ithaca, N.Y. Center for Radiophysics and Space Research.

EROSION, TRANSPORTATION AND THE NATURE OF THE MARIA

T. Gold Jul. 1971 24 p refs Submitted for publication

(Grant NGL-33-010-005)

(NASA-CR-125599; CRSR-452) Avail: NTIS CSCL 03B

Lunar Orbiter and Apollo photographs of the moon and laboratory simulations of a surface transportation mechanism are discussed. Studies of shoulders at junctions of old mountains with flat mare surfaces show that the crater density in the shoulder is lower than that in the neighboring ground. The crisscross pattern is very pronounced on the mountain slope, is on the shoulder in a smaller scale, and is absent on the mare surface. It is concluded that the material forming the shoulders came there as a consequence of a surface transportation mechanism, and that the shoulders reached their present configuration later than the final shaping of the mare surface. Seismic signal transmission and mascon distribution data indicate that the filling of mare basins did not occur in a similar manner. An electrostatic mechanism for surface transportation was studied experimentally by bombarding material with electrons. An electric field resulted which was capable of dislodging and moving grains. It was also found that the junction line between different materials remains sharp, and materials do not mix even when the junction line itself moves. N.E.N.

N72-18842*# Translation Consultants, Ltd., Arlington, Va.

RESULTS OF VISUAL OBSERVATIONS OF THE NIGHT, TWILIGHT, AND DAYTIME HORIZONS OF THE EARTH FROM THE SOYUZ 9 SPACECRAFT

K. Ya. Kondratyev, A. A. Buznikov, A. G. Nikolayev, V. I. Sevastyanov, and O. I. Smoktiy Washington NASA Feb. 1972 9 p refs Transl. into ENGLISH from Dokl. Akad. Nauk SSSR (USSR), v. 197, no. 3, 1971 p 574-577

(Contract NASw-2038)

(NASA-TT-F-13944) Avail: NTIS CSCL 03C

Visual observations were made of the night, twilight, and daytime horizons of the earth from the Soyuz 9 spacecraft. Average altitude of the flight between 1 and 19 April 1970, was 220 km. A luminous braid with branching ends in regions contiguous to the twilight aureole was observed for the first time in the earth's shadow zone on a planetary scale, and comparison of available data results in the conclusion that the phenomenon is most probably the result of photochemical, recombination, or geomagnetic processes taking place at night in a narrow transition region near the boundary between the homogeneous and heterogeneous parts of the earth atmosphere. Author

N72-18843*# Translation Consultants, Ltd., Arlington, Va.

FLIGHTS OF THE MULTIPLACE VOSKHOD AND VOSKHOD-2 SPACECRAFT

Washington NASA Dec. 1971 3 p refs Transl. into ENGLISH of "Polety Mnogomestnykh Korabley Voskhod i Voskhod-2" Leningrad, Acad. of Sci., 1971 4 p; Publ. by Nauka Press

(Contract NASw-2038)

(NASA-TT-F-14103) Avail: NTIS CSCL 22C

The flights of Soviet cosmonauts in the multiplace Voskhod and Voskhod-2 spacecraft are described. This was the first opportunity to conduct research using crews made up of different specialists and to leave the craft and walk in space. Author

N72-18844*# Scientific Translation Service, Santa Barbara, Calif.

SOVIET SPACE PROBES STUDY THE MOON

A. A. Gurshteyn and K. B. Shingarev Washington NASA Feb. 1972 13 p ref Transl. into ENGLISH from Priroda (Moscow), no. 1, Jan. 1971 p 2-6

(Contract NASw-2035)

(NASA-TT-F-13959) Avail: NTIS CSCL 22C

The Luna-16, Luna-17, Zond-8, and Lunashod-1 moon missions of September - November 1970 are described. Author

N72-18845*# Scientific Translation Service, Santa Barbara, Calif.

DIFFERENTIATION OF METEORIC MATTER IN THE EARTH'S ATMOSPHERE

K. P. Florenskiy and A. V. Ivanov Washington NASA Feb. 1972 18 p refs Transl. into ENGLISH from Meteoritika (Moscow), no. 30, 1970 p 104-113

(Contract NASw-2035)

(NASA-TT-F-14138) Avail: NTIS CSCL 03B

Heating, fusion, and atomization of meteoric bodies in the atmosphere are examined. It is shown that these processes can lead to an appreciable redistribution of elements which in turn leads to substantial changes in the mineralogical and chemical composition of the resulting spherules. The distribution of Ni and Co in the black magnetic spherules originating from the Tunguska fall shows that the coefficient of separation of elements can be very large. Fusion of microscopic particles of ferrous silicates is accompanied by incongruent decomposition into magnetic and silicate phase with subsequent separation of the phases. The content of elements in spherules cannot be used as a cosmogony criterion, owing to the substantial differentiation of matter in the formation of cosmic spherules. Author

N72-18846*# Scientific Translation Service, Santa Barbara, Calif.

PHYSICAL SELENOGRAPHY

V. V. Shevchenko Washington NASA Feb. 1972 21 p refs Transl. into ENGLISH from Priroda (USSR), no. 1, Jan. 1971 p 37-45

(Contract NASw-2035)

(NASA-TT-F-13960) Avail: NTIS CSCL 03B

Physical selenography is discussed in light of the most recent observations (Lunokhod-1, Apollo, observations from the earth). The gas distribution, surface composition, and other physical features of the moon are discussed. Author

N72-18847*# Jet Propulsion Lab., Calif. Inst. of Tech., Pasadena. Space Sciences Div.

FIXATION OF VIRGIN LUNAR SURFACE SOIL

J. M. Conley, R. Frazer, and W. A. Cannon 1 Feb. 1972 47 p refs

(Contract NAS7-100)

(NASA-CR-125680; JPL-TM-33-521) Avail: NTIS CSCL 03B

Two systems are shown to be suitable for fixing loose particulate soils with a polymer film, without visually detectable disturbance of the soil particle spatial relationships. A two-component system is described, which uses a gas monomer condensible at the soil temperature and a gas phase catalyst acting to polymerize the monomer. A one-component system using a monomer which polymerizes spontaneously on and within the top few millimeters of the soil is also considered. The two-component system employs a simpler apparatus, but it operates over a narrower temperature range (approximately -40 to -10 C). Other two-component systems were identified which may operate at soil temperatures as high as +100 C, at relatively narrow temperature ranges of approximately 30 C. The one-component system was demonstrated to operate successfully with initial soil temperatures from -70 C or lower to +150 C. Author

N72-18848*# IIT Research Inst., Chicago, Ill.

ASTEROID (FLORA AND EROS) SAMPLE-RETURN MISSIONS VIA SOLAR ELECTRIC PROPULSION

A. L. Friedlander Oct. 1971 77 p refs Prepared for JPL

(Contracts NAS7-100; JPL-952701)

(NASA-CR-125631; T-30) Avail: NTIS CSCL 22A

The characteristics and capabilities of solar electric propulsion for performing sample-return missions to the asteroids Flora and Eros are considered. Trajectory/payload analysis and mission design tradeoff options are emphasized. Author

N72-18849*# California Univ., Los Angeles. Inst. of Geophysics and Planetary Physics.

[NITROGEN FIXATION STUDIES, LEAD DETECTION IN LIVING PLANTS, AND SOLAR WIND ANALYSIS]

Semiannual Report, 1 Mar. - 31 Aug. 1971

W. F. Libby 31 Aug. 1971 7 p refs

(Grant NGL-05-007-003)

(NASA-CR-125665) Avail: NTIS CSCL 07D

Progress is reported for research on the following: (1) magnetically shielded test facility studies; (2) electrochemistry of B10C2H12, B9CH10(-), and preparation of tumor specific boron containing materials for use in cancer therapy; (3) histochemical method for determining lead in living plant tissue; (4) diamond cementing; (5) analysis of solar wind using the washings of lunar fines; and (6) environmental engineering. E.H.W.

N72-18850*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.

LAUNCH WINDOW ANALYSIS IN A NEW PERSPECTIVE WITH EXAMPLES OF DEPARTURES FROM EARTH TO MARS

Joseph R. Thibodeau, III. and Victor R. Bond Washington Mar. 1972 40 p refs

(NASA-TN-D-6641; MSC-S-289) Avail: NTIS CSCL 22A

Earth-departure windows are investigated for two round trip stopover missions to Mars. These are the 1981 inbound Venus swingby mission and the 1986 direct minimum-energy mission. The secular effects of planetary oblateness are used to predict the motion of the parking orbit. A procedure is developed for matching the motion of the parking orbit and the escape asymptote. Earth-departure velocity penalties, caused by orbital plane misalinement, are reduced by synchronizing the motion of the parking orbit and the escape trajectory. Author

N72-18851# Joint Publications Research Service, Arlington, Va.

SOVIET BLOCK RESEARCH IN GEOPHYSICS, ASTRONOMY, AND SPACE, NO. 271

28 Feb. 1972 67 p refs Transl. into ENGLISH from RUSSIAN articles

(JPRS-55287) Avail: NTIS

Materials from recent publications of the Sino-Soviet bloc countries are presented in the form of abstracts, summaries, and occasionally full articles. The topics covered are astronomy, meteorology, oceanography, geology, upper atmosphere, and space research. Author

N72-18852*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

GEOS SATELLITE TRACKING CORRECTIONS FOR REFRACTION IN THE IONOSPHERE

John H. Berbert and Horace C. Parker Dec. 1970 61 p refs

(NASA-TM-X-65827; X-514-70-467) Avail: NTIS CSCL 22C

The analytic formulations at different elevation angles and at a frequency of 2-GHz for the ionospheric refraction corrections used on the GEOS satellite tracking data are compared. The formulas and ray trace results for elevations greater than 10 deg, where most satellite tracking is done, differ in elevation, range, and range rate by less than 0.4 millidegrees (1.4 arc-seconds), 12 meters, and 12 cm/sec, respectively. In comparison to most operational requirements, this is insignificant. However, for the GEOS Observation Systems Intercomparison Investigation, these differences are equivalent in size to observed differences in system biases for some of the best electronic geodetic tracking systems and are probably contributing to the observed biases. The ray trace results and most of the more detailed analytic correction formulas show that the ionospheric refraction correction for range rate on an overhead pass is a maximum for elevation angles between 15 deg and 30 deg and falls off rapidly for both higher and lower elevation angles, contrary to the effect of the troposphere and to some reports in the literature. Author

N72-18853*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.

ERROR STUDIES FOR GROUND TRACKING OF SYNCHRONOUS SATELLITES

J. L. Cooley Jan. 1972 31 p refs

(NASA-TM-X-65831; X-551-72-30) Avail: NTIS CSCL 22C

The results of various sets of tracking error analysis studies of the ability of ground stations to determine the position and velocity of synchronous satellites are summarized. The effects of varying: (1) the ground station configuration from 1 to 6 tracking stations in differing locations; (2) the ground station measurement type such as S-Band, C-Band, VHF, and lasers and (3) the uncertainties in ground station location are investigated. The linear error analysis computer program used includes the effects of ground tracking station location uncertainties, measurement noise and biases, and station timing bias. Results show that two ground trackers are needed if at least 2000 meters position accuracy is desired, with a favorable two-station solution giving less than 500 meters position accuracy. Under favorable circumstances, a multi-station laser solution gives a synchronous satellite position accuracy of less than 100 meters. The various cases illustrate features of synchronous satellite tracking from ground stations. Author

N72-18854# California Inst. of Tech., Pasadena.

POSITION MEASUREMENTS OF MAIN-LINE OH/IR STARS

Ellen G. Hardebeck and William J. Wilson 1971 13 p refs Submitted for publication

(Contract N00014-67-A-0094-0019)

(AD-730975; Rept-1971-12) Avail: NTIS CSCL 03/2

Interferometer position measurements are reported for five main-line OH emission sources associated with infrared stars.

The results of the measurements show that in all cases the 1667-MHz OH emission originates from the stellar position, with typical errors of plus or minus 5 to plus or minus 15 in. of arc. In addition to the OH/IR star observations, the position of the mainline OH source OH2019-37 (ON-2) was measured. This source was found not to coincide with the red star BC Cyg as previous authors have suggested, but instead to be associated with an HII region. Author (GRA)

N72-18855# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.
A CATALOG OF DISTINCT SOLAR RADIO EVENTS FOR FIXED FREQUENCY OBSERVATIONS MADE AT THE PENNSYLVANIA STATE UNIVERSITY RADIO ASTRONOMY OBSERVATORY DURING THE PERIOD 1 JULY 1964 THROUGH 30 JUNE 1970. SECTION 2: CATALOG OF DISTINCT EVENTS
John P. Hagen and Frederick L. Wefer Aug. 1971 126 p
(Grants NSF GP-2986; NSF GA-720; NSF GA-1564; NSF GA-13714; NSF GA-28122)
(PB-203442; SR-023-2-Sect-2) Avail: NTIS CSCL 03B

The data is a catalog of the distinct solar radio events observed at PSURAO during the six year period 1 July 1964 through 30 June 1970. Nine pieces of information are usually given for each distinct event. These are the date, wavelength of the observation, time of start, time of maximum flux density, mean flux density, event type and the secant of the zenith angle. Author (GRA)

N72-18856# Pennsylvania State Univ., University Park. Radio Astronomy Observatory.
A CATALOG OF DISTINCT SOLAR RADIO EVENTS FOR FIXED FREQUENCY OBSERVATIONS MADE AT THE PENNSYLVANIA STATE UNIVERSITY RADIO ASTRONOMY OBSERVATORY DURING THE PERIOD 1 JULY 1964 THROUGH 30 JUNE 1970. SECTION 3: OPERATING HOURS
John B. Hagen and Frederick L. Wefer Aug. 1971 81 p
(Grants NSF GP-2986; NSF GA-720; NSF GA-1564; NSF GA-13714; NSF GA-28122)
(PB-203443; SR-023-3-Sect-3) Avail: NTIS CSCL 03B

Some of the applications of the data contained in N72-18855 require a knowledge of the time intervals during which solar radio bursts could have been observed. These time intervals are given for the six year period 1 July 1964 through 30 June 1970. Author (GRA)

N72-18857# Aerospace Corp., El Segundo, Calif. Lab. Operations.
RADIO SOURCES: 3.3mm FLUX AND VARIABILITY MEASUREMENTS Technical Report, Apr. 1965 - Mar. 1971
William G. Fogarty, Eugene E. Epstein, John W. Montgomery, and Michael M. Dworetsky 15 Aug. 1971 32 p refs
(Contract F04701-71-C-0172)
(AD-731552; TR-0172(2230-20)-5; SAMSO-TR-71-225) Avail: NTIS CSCL 03/2

Graphical and tabular summaries of 3.3-mm (90-GHz) flux measurements of 35 discrete galactic and extragalactic sources are presented, including results of extensive monitoring of nine sources. Variability at 3.3-mm is certain for NGC 1068, NGC 1275, 3C120, 3C273, 3C279, VRO 42.22.01, and 3C454.3; repeated outbursts with time scales ranging from a week to several months have been observed for all of these except NGC 1068 and 3C454.3. Author (GRA)

N72-18858# Illinois Univ., Urbana.
MATERIALS SCIENCES RESEARCH Annual Technical Report, 1970 - 1971
1 Jan. 1972 206 p refs
(Contract DAHC15-67-C-0221)
(AD-733724) Avail: NTIS CSCL 14/2

The report summarizes research at the Materials Research Laboratory of the University of Illinois. Research in the following areas is described: Ceramic engineering; Chemistry and chemical engineering; Electrical engineering; Geology; Metallurgy and mining engineering; Physics. GRA

N72-18249# Academy of Sciences (USSR), Moscow.
STUDY OF THE TOPOGRAPHY OF THE REGION ALONG THE PATH OF LUNOKHOD 1
B. N. Rodionov, B. V. Nepoklonov, and V. V. Kiselev *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 65-73 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

N72-18250# Academy of Sciences (USSR), Moscow.
DETERMINATION OF THE GEOMETRIC DIMENSIONS AND DISTRIBUTION OF CRATERS ENCOUNTERED BY THE LUNOKHOD 1 PROBE ON THE MOON'S SURFACE
V. I. Garin, A. K. Leonovich, F. P. Pavlov, V. B. Georgiyev, and P. S. Semenov *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 74-77 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

N72-18251# Academy of Sciences (USSR), Moscow.
OBSERVATIONS OF THE MECHANICAL PROPERTIES OF THE LUNAR SOIL BY THE SELF-PROPELLED APPARATUS LUNOKHOD 1
A. K. Leonovich, V. V. Gromov, A. V. Rybakov, V. K. Petrov, P. S. Pavlov, I. I. Cherkasov, and V. V. Shvarev *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 78-88 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

N72-18253# Academy of Sciences (USSR), Moscow.
PRELIMINARY RESULTS OF GEOMORPHOLOGIC STUDIES
K. P. Florenskiy, A. T. Bazilevskiy, A. A. Pronin, and Z. V. Popova *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 96-115 refs In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

31 SPACE VEHICLES

Includes launch vehicles; manned space capsules; clustered and multistage rockets; satellites; sounding rockets and probes; and operating problems. For basic research see: 30 Space Sciences. For related information see also: 28 Propulsion Systems; and 32 Structural Mechanics.

N72-18859* Lockheed Missiles and Space Co., Sunnyvale, Calif.
EMERGENCY EARTH ORBITAL ESCAPE DEVICE Patent
Raymond H. Bradley, Warren K. Carter, Louis A. DeLateur, and Dean Chowing, inventors (to NASA) Issued 20 Sep. 1971 7 p Filed 2 Feb. 1970 Sponsored by NASA
(NASA-Case-MSC-13281; US-Patent-3,606,212; US-Patent-Appl-Sn-7669; US-Patent-Class-244-15.5) Avail: US Patent Office CSCL 22B

A space vehicle is constructed from dissimilar right angle conical sections mated along their bases and having their apexes truncated and spherically rounded to provide the unique property of single point aerodynamic and hydrodynamic stability. A 40 deg half-angle cone section forms the forward end of the vehicle and is covered with a heat shield to dissipate heat generated upon reentry. A 30 deg half-angle cone forms the aft section and includes an entry hatch and window. A separable module secured to the leading end carries control thrusters and retrorocket motors for orienting the vehicle and decelerating it out of orbit toward the earth. Passive power and life support systems are

employed to increase storage life and reaction time of the vehicle. The relative position of the vehicle's center of gravity, center of aerodynamic pressure, and hydrodynamic metacenter resulting from the configuration of the two conical sections render the craft stable in the correct position of heat shield leading during free fall through the atmosphere and with the aft end above the water when floating.
Official Gazette of the U.S. Patent Office

N72-18860 Centre National d'Etudes Spatiales, Paris (France).
PERFORMANCE IMPROVEMENT OF THE DIAMANT LAUNCHER [AMELIORATION DES PERFORMANCES DU LANCEUR DIAMANT]
Jean-Gerard Roussel and Nguyen VanNhan (ONERA) Sep. 1971 32 p refs In FRENCH Presented at the 22d Intern. Congr. on Astronaut., Brussels, 20-25 Sep. 1971
(ONERA-TP-1015) Avail: Issuing Activity

Mission needs for the Diamant rocket launcher are evaluated. A description is presented for the Diamant BC launcher, and improvement of its performance is considered by the addition of a 4th and 5th stage. Hypotheses and methods of calculation, launch performance, dispersion and correction, maneuverability, perigee-apogee diagrams, and rocket configurations are all discussed. Transl. by K.P.D.

N72-18861*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
INFORMATION TRANSFER SATELLITE CONCEPT STUDY. VOLUME 1: SUMMARY Final Report
P. Bergin, C. Kincade, D. Kurpiewski, F. Leinhaupel, F. Millican, and R. Onstad 15 May 1971 33 p ref
(Contract NAS2-5571)
(NASA-CR-114311; GDC-DCF70-003-Vol-1) Avail: NTIS CSCL 22B

A wide range of information transfer demands were identified and analyzed. They were then combined into an appropriate set of requirements for satellite communication services. In this process the demands were ranked and combined into single and multipurpose satellite systems. A detailed analysis was performed on each satellite system to determine: total system cost, including both ground and space segments; sensitivities of the systems to various system tradeoffs; and forcing functions which control the system variations. A listing of candidate missions for detailed study is presented, along with a description of the conceptual system design and an identification of the technology developments required to bring these systems to fruition. Author

N72-18862*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
INFORMATION TRANSFER SATELLITE CONCEPT STUDY. VOLUME 2: TECHNICAL Final Report
P. Bergin, C. Kincade, D. Kurpiewski, F. Leinhaupel, F. Millican, and R. Onstad 15 May 1971 352 p refs
(Contract NAS2-5571)
(NASA-CR-114312; GDC-DCF70-003-Vol-2) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The ITS concept study is preceded by two requirements studies whose primary objectives are to identify viable demands and to develop the functional requirements associated with these demands. In addition to continuing this basic activity the ITS concept study objectives are to: (1) develop tools and techniques for planning advanced information transfer satellite communications systems, and to (2) select viable systems for further analysis both in their near-term and in the far-term aspects.
Author

N72-18863*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
INFORMATION TRANSFER SATELLITE CONCEPT STUDY. VOLUME 3: APPENDICES Final Report
P. Bergin, C. Kincade, D. Kurpiewski, F. Leinhaupel, F. Millican, and R. Onstad 15 May 1971 483 p
(Contract NAS2-5571)
(NASA-CR-114313; GDC-DCF70-003-Vol-3) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Briefly reviewed are the various documents which supply background information for the information transfer satellite study. The sixteen papers reviewed are evaluated in terms of: (1) the category of service or demand being treated; (2) the extent to which information transfer predictions are quantified; (3) the degree to which the data supplied is adequate for the purposes of system synthesis; (4) some assessment as to the overall utility of the data presented in the paper. Author

N72-18864*# General Dynamics/Convair, San Diego, Calif. Advanced Space Systems.
INFORMATION TRANSFER SATELLITE CONCEPT STUDY. VOLUME 4: COMPUTER MANUAL Final Report
P. Bergin, C. Kincade, D. Kurpiewski, F. Leinhaupel, F. Millican, and R. Onstad 15 May 1971 61 p
(Contract NAS2-5571)
(NASA-CR-114314; GDC-DCF70-003-Vol-4) Avail: NTIS CSCL 22B

The Satellite Telecommunications Analysis and Modeling Program (STAMP) provides the user with a flexible and comprehensive tool for the analysis of ITS system requirements. While obtaining minimum cost design points, the program enables the user to perform studies over a wide range of user requirements and parametric demands. The program utilizes a total system approach wherein the ground uplink and downlink, the spacecraft, and the launch vehicle are simultaneously synthesized. A steepest descent algorithm is employed to determine the minimum total system cost design subject to the fixed user requirements and imposed constraints. In the process of converging to the solution, the pertinent subsystem tradeoffs are resolved. This report documents STAMP through a technical analysis and a description of the principal techniques employed in the program. Author

N72-18865*# Chrysler Corp., New Orleans, La. Space Div.
AERODYNAMIC CHARACTERISTICS OF SEVERAL LAUNCH CONFIGURATIONS UTILIZING THE TITAN 3 L BOOSTER AND MMC DTO-7 ORBITER
D. J. Michna Jan. 1972 692 p
(Contract NAS8-4016)
(NASA-CR-120011; DMS-DR-1182; NASA-Ser-S-1044) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The .00429 scale model Titan 3 booster was mated with the DTO-7 space shuttle orbiter with drop tanks and tested for aerodynamic performance in a 14 x 14 inch trisonic wind tunnel. Six component aerodynamic force and moment data were measured on several variations of the above component in a launch configuration over a Mach number range from 0.6 to 3.48. Angle of attack ranged from -12 deg to 12 deg at 0 deg and -6 deg sideslip angle and sideslip angle ranged from -12 deg to 12 deg at 0 deg angle of attack. Date are presented in plotted form in both the stability and body axis system. Author

N72-18866*# Chrysler Corp., New Orleans, La. Space Div.
EFFECTS OF CRUISE ENGINE LOCATION AND POWER ON INTERFERENCE
Dale Bradley Feb. 1972 715 p refs
(Contract NAS8-4016)
(NASA-CR-120005; DMS-DR-1164; NASA-Ser-S-1010) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Data are presented, in plotted form, of tests for determining the interference effects of space shuttle booster cruise engine location for power-on and power-off conditions. The tests were conducted in a 7 x 10 foot transonic wind tunnel; the model was a 0.015-scale space shuttle booster specially equipped for propulsion effects testing. Data were obtained over a Mach number range of 0.4 to 1.13 at angles of attack from -4 deg to 20 deg at zero degrees sideslip and at angles of sideslip from -6 deg to +6 deg at constant angles of attack of 0 deg, 6 deg, 15 deg, and in some cases 10 deg. Additional parameters investigated were: elevon deflection, canard deflection, aileron deflection, rudder deflection, canard position, and mass flow rate. Author

N72-18867*# Grumman Aerospace Corp., Bethpage, N.Y. Space Shuttle Program.
DEFINITION OF SPACE SHUTTLE PROGRAM PLAN, STUDY
16 Nov. 1971 80 p
(Contract NAS9-11160)
(NASA-CR-115384; B35-43RP-25; MSC-03820; DRL-T-752; DRD-SE-417T) Avail: NTIS CSCL 22B

The preliminary definition of an economical space shuttle program in which the evolution to full operational capability is achieved through phased subsystem development is presented. The following aspects of the program are discussed: (1) definition of system and subsystem configurations, (2) definition of phased evolution to final configuration, (3) analysis of design, test, cost, and schedule requirements, (4) definition of candidate booster designs and programs to facilitate selection, and (5) definition of program, system, and vehicle requirements. Author

N72-18868*# Boeing Co., Houston, Tex. Propulsion and Power Systems.
APOLLO OXYGEN TANK STRATIFICATION ANALYSIS, VOLUME 2 Final Report
J. E. Barton and H. W. Patterson 31 Jan. 1972 36 p refs
(Contract NAS9-11576)
(NASA-CR-115400; D2-118406-2-Vol-2) Avail: NTIS CSCL 22B

An analysis of flight performance of the Apollo 15 cryogenic oxygen tanks was conducted with the variable grid stratification math model developed earlier in the program. Flight conditions investigated were the CMP-EVA and one passive thermal control period which exhibited heater temperature characteristics not previously observed. Heater temperatures for these periods were simulated with the math model using flight acceleration data. Simulation results (heater temperature and tank pressure) compared favorably with the Apollo 15 flight data, and it was concluded that tank performance was nominal. Math model modifications were also made to improve the simulation accuracy. The modifications included the addition of the effects of the tank wall thermal mass and an improved system flow distribution model. The modifications improved the accuracy of simulated pressure response based on comparisons with flight data. Author

N72-18869*# Stanford Univ., Calif. Guidance and Control Lab.
A PRELIMINARY DESIGN OF A DRAG-FREE SATELLITE AND ITS APPLICATION TO GEODESY Final Technical Report
Benjamin O. Lange, Daniel B. DeBra, and William M. Kaula (Calif. Univ., Los Angeles) May 1969 191 p refs
(Contract NAS12-695)
(NASA-CR-125606) Avail: NTIS CSCL 22B

The design of a drag-free satellite and its application to measuring tidal interaction of the earth and tesseral harmonics are discussed. Principle areas of discussion are: (1) the feasibility of making geophysical measurements which are not possible with conventional satellites, and (2) design of attitude and translation control systems for spinning vehicle and possible coupling of attitude and translation control for gravity stabilized vehicles. Author

N72-18870*# Boeing Scientific Research Labs., Seattle, Wash. Research and Engineering Div.
JOVIAN SATELLITE ECLIPSE STUDY. 1: 1971 ECLIPSES Final Report
T. F. Greene, R. W. Shorthill, and L. G. Despain Oct. 1971 358 p refs
(Contract NASw-2205)
(NASA-CR-125602; D1-80-14193-1) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Observations of five Jovian satellite eclipses were obtained during February, March, and April 1971 with the 200-inch Hale telescope and multichannel spectrometer. Eclipse light curves in 20 wavelength bandpasses were obtained for each eclipse. Author

N72-18871*# Grumman Aerospace Corp., Bethpage, N.Y.
SHUTTLE SYSTEMS EVALUATION AND SELECTION. VOLUME 1: EXECUTIVE SUMMARY
15 Dec. 1971 25 p Prepared in cooperation with Boeing Co.
(Contract NAS9-11160)
(NASA-CR-115426; MSC-038222-Vol-1; B35-43; RP-30) Avail: NTIS CSCL 22B

The major issues affecting the selection of a space shuttle system were considered. These included the HO orbiter/ballistic recoverable booster series-burn configuration; the HO orbiter/ballistic recoverable booster parallel-burn (rocket-assisted orbiter-RAO) configuration; and the HO orbiter/flyback LOX/RP booster configuration. The booster studies emphasized the series-burn ballistic design, but the differences required for RAO application were identified and evaluated. Definition of the RAO configuration parameters and technical problem areas, establishing approaches to possible solutions, and developing program costs are discussed. Author

N72-18872*# Grumman Aerospace Corp., Bethpage, N.Y.
SPACE SHUTTLE LOW COST/RISK AVIONICS STUDY Final Report
12 Nov. 1971 331 p Prepared in cooperation with Boeing Co.
(Contract NAS9-11160)
(NASA-CR-115427; B35-43RP-26; MSC-03818) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

All work breakdown structure elements containing any avionics related effort were examined for pricing the life cycle costs. The analytical, testing, and integration efforts are included for the basic onboard avionics and electrical power systems. The design and procurement of special test equipment and maintenance and repair equipment are considered. Program management associated with these efforts is described. Flight test spares and labor and materials associated with the operations and maintenance of the avionics systems throughout the horizontal flight test are examined. It was determined that cost savings can be achieved by using existing hardware, maximizing orbiter-booster commonality, specifying new equipments to MIL quality standards, basing redundancy on cost effective analysis, minimizing software complexity and reducing cross strapping and computer-managed functions, utilizing compilers and floating point computers, and evolving the design as dictated by the horizontal flight test schedules. Author

N72-18873*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION, PHASE B EXTENSION. PROGRAM OPERATIONS PLAN
30 Nov. 1971 20 p
(Contract NAS9-9953)
(NASA-CR-115386; MSC-02477; SD-71-223) Avail: NTIS CSCL 22B

An organized approach is defined for establishing the most significant requirements pertaining to mission operations, information management, and computer program design and development for the modular space station program. The operations plan pertains to the space station and experiment module program elements and to the ground elements required for mission management and mission support operations. Author

N72-18874*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION: SHUTTLE INTERFACE REQUIREMENTS
7 Dec. 1971 100 p

(Contract NAS9-9953)
(NASA-CR-115387; SD-71-221) Avail: NTIS CSCL 22B

The interface requirements cover both the ground and orbital phases of operation from the launch of the first MSS module until the initial modular station has been manned and in routine operation. As a point of reference, the two-stage, fully reusable space shuttle was selected. The space shuttle is briefly described from the standpoint of its features most important to the interface requirements with the MSS. The environment induced upon the MSS elements when transported to and from orbit by the shuttle orbiter also is included. The mission operation includes the space shuttle launch facilities, the ground flow of the MSS modules, and the orbital operations of rendezvous, MSS buildup, resupply of the manned station, and orbiter descent and landing. The shuttle's once-around abort case is described as it affects the MSS interface requirements. The interfaces between the orbiter and the MSS resulting from the ground and orbital operations, are also described. Author

N72-18875*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
APOLLO 14 MISSION: INABILITY TO DISCONNECT MAIN BUS A Anomoly Report
Dec. 1971 3 p
(NASA-TM-X-67543; MSC-05242) Avail: NTIS CSCL 22B

During entry, the Apollo 14 spacecraft busses should have de-energized when the main bus-tie motor switches were switched to the off position. One motor switch did not transfer and main bus A remained energized until the battery bus-tie circuit breakers were opened after landing. Analysis revealed that residual catalyst caused the terminal pin seals to revert to a gummy state. Resulting reversion products then migrated to the motor commutator and caused brush degradation, increased and erratic commutator resistance, and reduced motor torque. The motor stalled when available motor torque was reduced below that required to drive through the maximum torque point of the switch. Author

N72-18876*# National Aeronautics and Space Administration. Goddard Space Flight Center, Greenbelt, Md.
MAGNETIC FIELD RESTRAINTS FOR SPACECRAFT SYSTEMS AND SUBSYSTEMS, SUPPLEMENT 1
Charles A. Harris Dec. 1971 40 p
(NASA-TM-X-65816; X-325-71-488; X-325-67-70(s)) Avail: NTIS CSCL 22B

An update is presented for the information contained in a NASA publication on magnetic field restraints for spacecraft systems and subsystems. Author

N72-18877*# Northrop Services, Inc., Huntsville, Ala.
SHUTTLE ASCENT AND SHOCK IMPINGEMENT AERODYNAMIC HEATING STUDIES Final Report
W. D. Lanning and F. T. Hung Dec. 1971 656 p refs
(Contract NAS8-26268)
(NASA-CR-123533; TR-220-1039) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

The collection and analysis of aerodynamic heating data obtained from shock impingement experimental investigation were completed. The data were categorized into four interference areas; fin leading edge, wing/fuselage fin/plate corners, and space shuttle configurations. The effects of shock impingement were found to increase the heating rates 10 to 40 times the undisturbed values. A test program was completed at NASA/Langley Research Center to investigate the magnitudes and surface patterns of the mated shock interference flowfield. A 0.0065 scale thin-skin model of the MDAC 256-20 space shuttle booster mated with a Stycast model of the MDAC Internal tank orbiter was tested in the 20-inch $M=6$ tunnel, the 31-inch $M=10$ tunnel, and the 48-inch Unitary Plan Tunnel. The gap region of the ascent configuration was the principal area of interest where both thermocouple and phase-change paint data were obtained. Pressure and heat transfer distributions data on the leeward surface of a 75-degree sweep slab delta wing are presented. The effects of surface roughness on boundary layer transition and aerodynamic heating were investigated. Author

N72-18878*# Chrysler Corp., New Orleans, La. Space Div.
SPACE SHUTTLE: AERODYNAMIC CHARACTERISTICS OF THE TITAN T 3 (1207-4)/GAC H-33 LAUNCH CONFIGURATION
J. Frank Sims Feb. 1972 358 p
(Contract NAS8-4016)
(NASA-CR-120017; DMS-DR-1188; NASA-Ser-S-1041) Avail: NTIS CSCL 22B

Aerodynamic data obtained in a 14-inch trisonic wind tunnel test on static stability and drag of 0.003366-scale models of the Grumman H-33 drop tank orbiter and the Titan T 3 (1207-4) expendable booster are presented. The orbiter was mounted to the booster both piggyback and tandem. Data were obtained over a Mach number range of 0.6 to 5.0. Angle of attack data were obtained from -16 deg to +4 deg at both 0 deg and -6 deg sideslip for the piggyback configuration, but were limited to -10 deg to +10 deg at 0 deg sideslip for the tandem configuration. Primary configuration variations, other than piggyback and tandem mount, were the number and location of solid propellant strap-on boosters. Author

N72-18879*# Translation Consultants, Ltd., Arlington, Va.
THE "KOSMOS" ARE EARTH SATELLITES, SCIENTIFIC SATELLITES
M. Fedorov, L. Sergeyev, R. Rabinovich, and V. Matazov Washington NASA Feb. 1972 5 p Transl. into ENGLISH from Aviats. i Kosmonavt. (Moscow), no. 3, Mar. 1971 p 36-37
(Contract NASw-2038)
(NASA-TT-F-13956) Avail: NTIS CSCL 22B

The instrumentation and operation of the ionospheric probe Cosmos 381 are briefly described. The satellite is equipped for vertical sounding of the ionosphere and to observe solar ultraviolet radiation, low frequency radiation, and cosmic rays. Communication and orientation equipment are also mentioned. N.E.N.

N72-18880*# National Aeronautics and Space Administration. Marshall Space Flight Center, Huntsville, Ala.
APOLLO TELESCOPE MOUNT THERMAL SYSTEMS UNIT THERMAL VACUUM TEST
H. F. Trucks, Une Hueter, J. H. Wise, and F. D. Bachtel Washington Mar. 1971 72 p refs
(NASA-TN-D-6646; M-372) Avail: NTIS CSCL 22B

The Apollo Telescope Mount's thermal systems unit was utilized to conduct a full-scale thermal vacuum test to verify the thermal design and the analytical techniques used to develop the thermal mathematical models. Thermal vacuum test philosophy, test objectives configuration, test monitoring, environment simulation, vehicle test performance, and data correlation are discussed. Emphasis is placed on planning and execution of the thermal vacuum test with particular attention on problems encountered in conducting a test of this maguitude. Author

N72-18881*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY SYSTEM DESIGN. VOLUME 1: SUMMARY
A. L. Jones Jan. 1972 87 p
(Contract NAS9-9953)
(NASA-CR-115405; SD-71-217-1-Vol-1) Avail: NTIS CSCL 22B

The design and operation of the initial modular space station are summarized. The design for a crew of six is presented and concepts for growth to twelve are discussed, including the configuration, subsystems, experiment laboratories, and flight operations. Station module designs are described and design features of the arrangements, configuration, and subsystems are discussed. A reference experiment program is presented which includes a representative phasing of experiment activity for both initial and growth stations. The flight operations required for station assembly and for carrying out the reference experiment program are also covered. Author

N72-18882*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY SYSTEM DESIGN. VOLUME 2: OPERATIONS AND CREW ANALYSES
R. D. Meston, M. R. Schall, Jr., C. L. Brockman, and W. H. Bender Jan. 1972 192 p refs
(Contract NAS9-9953)
(NASA-CR-115406; SD-71-217-2-Vol-2) Avail: NTIS CSCL 22B

All analyses and tradeoffs conducted to establish the MSS operations and crew activities are discussed. The missions and subsystem integrated analyses that were completed to assure compatibility of program elements and consistency with program objectives are presented. Author

N72-18883*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY SYSTEM DESIGN. VOLUME 3: EXPERIMENT ANALYSES
G. L. Wengrow and A. N. Lillenas Jan. 1972 269 p
(Contract NAS9-9953)
(NASA-CR-115407; SD-71-217-3-Vol-3; MSC-T-575-Vol-3; MSC-02471-Vol-3) Avail: NTIS CSCL 22B

Experiment analysis tasks performed during program definition study are described. Experiment accommodation and scheduling, and defining and implementing the laboratory evolution are discussed. The general purpose laboratory requirements and concepts are defined, and supplemental studies are reported. Author

N72-18884*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION, PRELIMINARY SYSTEM DESIGN. VOLUME 4: SUBSYSTEMS ANALYSES
R. W. Antell Jan. 1972 565 p refs
(Contract NAS9-9953)
(NASA-CR-115408; SD-71-217-4-Vol-4; DRL-MSC-T-575) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

The subsystems tradeoffs, analyses, and preliminary design results are summarized. Analyses were made of the structural and mechanical, environmental control and life support, electrical power, guidance and control, reaction control, information, and crew habitability subsystems. For each subsystem a summary description is presented including subsystem requirements, subsystem description, and subsystem characteristics definition (physical, performance, and interface). The major preliminary design data and tradeoffs or analyses are described in detail at each of the assembly levels. Author

N72-18885*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY SYSTEMS DESIGN REPORT. VOLUME 6: TRADES AND ANALYSES
A. L. Jones Jan. 1972 527 p refs
(Contract NAS9-9953)
(NASA-CR-115411; SD-71-217-6-Vol-6; DRL-MSC-T-575) Avail: NTIS HC $6.00/MF $0.95 CSCL 22B

Requirements and concepts and the tradeoff analysis leading to the preferred concept are presented. Integrated analyses are given for subsystems and thermal control. Specific tradeoffs and analyses are also given for water management, atmosphere control, energy storage, radiators, navigation, control moment gyros, and system maintenance. The analyses of manipulator concepts and requirements, and supplemental analyses of information management issues are summarized. Subsystem reliability analyses include a detailed discussion of the critical failure analysis. Author

N72-18886*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PRELIMINARY SYSTEM DESIGN. VOLUME 7: ANCILLARY STUDIES
A. L. Jones Jan. 1972 319 p
(Contract NAS9-9953)
(NASA-CR-115397; SD-71-217-7-Vol-7; DRL-MSC-T-575) Avail: NTIS CSCL 22B

Sortie mission analysis and reduced payloads size impact studies are presented. In the sortie mission analysis, a modular space station oriented experiment program to be flown by the space shuttle during the period prior to space station IOC is discussed. Experiments are grouped into experiment packages. Mission payloads are derived by grouping experiment packages and by adding support subsystems and structure. The operational and subsystems analyses of these payloads are described. Requirements, concepts, and shuttle interfaces are integrated. The sortie module/station module commonality and a sortie laboratory concept are described. In the payloads size analysis, the effect on the modular space station concept of reduced diameter and reduced length of the shuttle cargo bay is discussed. Design concepts are presented for reduced sizes of 12 by 60 ft, 14 by 40 ft, and 12 by 40 ft. Comparisons of these concepts with the modular station (14 by 60 ft) are made to show the impact of payload size changes. Author

N72-18887*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PROGRAM COST AND SCHEDULES. VOLUME 1: COST AND SCHEDULE ESTIMATING PROCESS AND RESULTS
G. J. Frassinelli Jan. 1972 262 p refs
(Contract NAS9-9953)
(NASA-CR-115392; SD-71-226-1-Vol-1; DRL-MSC-T-575) Avail: NTIS CSCL 22B

Cost estimates and funding schedules are presented for a given configuration and costing ground rules. Cost methodology is described and the cost evolution from a baseline configuration to a selected configuration is given, emphasizing cases in which cost was a design driver. Programmatic cost avoidance techniques are discussed. Author

N72-18888*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PROGRAM COST AND SCHEDULES. VOLUME 2: APPENDIXES
G. J. Frassinelli Jan. 1972 149 p
(Contract NAS9-9953)
(NASA-CR-115393; SD-71-226-2-Vol-2-App; DRL-MSC-T-575) Avail: NTIS CSCL 22B

A work breakdown structure and dictionary, estimated subcontractor costs, and technical characteristics data are presented for the cost estimates and funding schedule studies. Author

N72-18889*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PERIOD EXECUTIVE SUMMARY
A. A. Tischler and C. L. Could Jan. 1972 99 p
(Contract NAS9-9953)
(NASA-CR-115404; SD-71-214; DRL-MSC-T-575) Avail: NTIS CSCL 22B

A narrative summary is presented of technical, programmatic, and planning information developed during the space station definition study extension period. The modular space station is emphasized, but tasks pertaining to shuttle sorties missions and information management advanced development are included. A series of program options considering technical, schedule, and programmatic alternatives to the baseline program are defined and evaluated. Author

N72-18890*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION MOCKUP REVIEW AND EVALUATION
Carl L. Brockman and Myron R. Schall 21 Jan. 1972 66 p
(Contract NAS9-9953)
(NASA-CR-115412; SD-71-220; DRL-MSC-T-575) Avail: NTIS CSCL 22B

The modular space station mockup is described in detail with emphasis on the interior arrangements of the crew living spaces, control center, and general purpose laboratory facilities. The results of three mockup reviews are also presented. Author

N72-18891*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION INTEGRATED GROUND OPERATIONS
D. F. SeLegue 7 Dec. 1971 398 p
(Contract NAS9-9953)
(NASA-CR-115403; SD-71-222; DRL-MSC-T-575) Avail: NTIS CSCL 22D

Requirements for development test, manufacturing, facilities, GSE, training, logisitics support, and launch operations are described. The prime integrating requirement is the early establishment of a common data base and its use throughout the design, development, and operational life of the station. The common data base is defined, and the concept of its use is presented. Development requirements for the station modules and subsystems are outlined along with a master development phasing chart. Author

N72-18892*# North American Rockwell Corp., Downey, Calif. Space Div.
MODULAR SPACE STATION PHASE B EXTENSION PROGRAM MASTER PLAN
E. H. Munsey Dec. 1971 160 p
(Contract NAS9-9953)
(NASA-CR-115394; SD-71-225; DRL-MSC-T-575) Avail: NTIS CSCL 22B

The project is defined for design, development, fabrication, test, and pre-mission and mission operations of a shuttle-launched modular space station. The project management approach is described in terms of organization, management requirements, work breakdown structure, schedule, time-phased logic, implementation plans, manpower, and funding. The programmatic and technical problems are identified. Author

N72-18893*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION PROGRAM (MODULAR) COST ESTIMATES DOCUMENT. VOLUME 1: PROGRAM ESTIMATES
Dec. 1971 113 p refs 2 Vol.
(Contract NAS8-25140)
(NASA-CR-123492; MDC-G2702-Vol-1) Avail: NTIS CSCL 22B

The program, project, system level cost and schedule data for the modular space station development are presented. Author

N72-18894*# McDonnell-Douglas Astronautics Co., Huntington Beach, Calif.
SPACE STATION PROGRAM MODULAR COST ESTIMATES DOCUMENT. VOLUME 2: SUBSYSTEM ESTIMATES
Dec. 1971 162 p refs 2 Vol.
(Contract NAS8-25140)
(NASA-CR-123493; MDC-G2702-Vol-2) Avail: NTIS CSCL 22B

Subsystem estimates for the modular space station development contain the cost and schedule data as well as appendices with task descriptions and cost estimate data forms. Author

N72-18895*# National Aeronautics and Space Administration. Flight Research Center, Edwards, Calif.
STATISTICAL ANALYSIS OF LANDING CONTACT CONDITIONS FOR THREE LIFTING BODY RESEARCH VEHICLES
Richard R. Larson Washington Mar. 1972 32 p refs
(NASA-TN-D-6708; H-684) Avail: NTIS CSCL 22C

The landing contact conditions for the HL-10, M2-F2/F3, and the X-24A lifting body vehicles are analyzed statistically for 81 landings. The landing contact parameters analyzed are true airspeed, peak normal acceleration at the center of gravity, roll angle, and roll velocity. Ground measurement parameters analyzed are lateral and longitudinal distance from intended touchdown, lateral distance from touchdown to full stop, and rollout distance. The results are presented in the form of histograms for frequency distributions and cumulative frequency distribution probability curves with a Pearson Type 3 curve fit for extrapolation purposes. Author

N72-18896*# Aerojet Liquid Rocket Co., Sacramento, Calif.
FEASIBILITY STUDY OF A PRESSURE FED ENGINE FOR A WATER RECOVERABLE SPACE SHUTTLE BOOSTER VOLUME 2: TECHNICAL, PHASE A EFFORT Final Report
18 Jan. 1972 626 p refs
(Contract NAS8-28217)
(NASA-CR-123534) Avail: NTIS HC $9.00/MF $0.95 CSCL 22B

Design and systems considerations are presented on an engine concept selection for further preliminary design and program evaluation. These data have been prepared from a feasibility study of a pressure-fed engine for the water recoverable space shuttle booster. Author

N72-18897# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
HEAT SHIELDING OF SPACE VEHICLES
Yu. Yepishkin 8 Sep. 1971 15 p Transl. into ENGLISH from Aviat. Kosmonavt. (USSR), no. 10, 1969 p 37-39
(AD-733216; FTD-MT-24-969-71) Avail: NTIS CSCL 22/2

The great variation of parameters of re-entry of space vehicles into the atmosphere determines various methods for heat shielding of their structures. Four such methods are known: heat sink, forced cooling, emission radiation, and heat protective coating. Since heat-shielding materials may differ in the components entering into the composition, their percent content, technology of manufacture, then naturally it becomes necessary to sample and evaluate their effectiveness. Testing for this purpose is performed either in electric arc tubes or on installations where, in creating heat flows use is made of liquid and solid propellant engines. In many practically important cases, removal of material from the surface of the coating is not great and here the depth of heat penetration is of great significance. In order to reduce heating through, complex heat shielding schemes are used. In so doing, under the layer of the upper heat-shielding coating one or several heat-shielding layers with low thermal conductivity and small volume weight are placed. With the growth of re-entry, the weight of heat shielding comprises an already significant part of the weight of the whole vehicle. Therefore great significance is attached to the study of the behavior of heat-shielding materials under conditions of high radiative heat flows. Author (GRA)

N72-18898# Air Force Rocket Propulsion Lab., Edwards AFB, Calif.
SATELLITE PROPULSION SYSTEM ANALYSIS Final Report,

Oct. 1970 - Jun. 1971
Raymond D. Klopotek and Walden L. S. Laukhuf Sep. 1971 164 p refs
(AF Proj. 3058)
(AD-733714; AFRPL-TR-71-108) Avail: NTIS CSCL 22/2

Propulsion systems were studied for post-1975 geosynchronous satellites that have stringent attitude and station maintenance requirements with mission durations of up to 10 years. Systems using catalytic monopropellant, nuclear-thermal monopropellant, chemical bipropellants and electric thrusters were studied and ranked according to several analysis areas which included propulsion system weight, system reliability and costs. Areas requiring further technology development are recommended on the basis of system rankings. Author (GRA)

N72-18244# Academy of Sciences (USSR), Moscow.
THE BASIC APPARATUS AND LAYOUT OF THE LUNA 17 SPACE PROBE
K. S. Anisov, V. I. Mastakov, O. G. Ivanov, L. N. Leonidov, G. N. Nikolayev, A. D. Dneprov, A. K. Alksandrov, P. S. Semenov, A. F. Grachev, V. I. Komarov et al *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 7-20 In RUSSIAN (See N72-18243 09-11)
Avail: NTIS

32 STRUCTURAL MECHANICS

Includes structural element design and weight analysis; fatigue; thermal stress; impact phenomena; vibration; flutter; inflatable structures; and structural tests. For related information see also: 17 Materials, Metallic; and 18 Materials, Nonmetallic.

N72-18899*# National Aeronautics and Space Administration, Washington, D.C.
TESTING METHODS AND TECHNIQUES: STRENGTH OF MATERIALS AND COMPONENTS. A COMPILATION
1971 26 p refs
(NASA-SP-5944(01)) Avail: NTIS CSCL 20K

The methods, techniques, and devices used in testing the mechanical properties of various materials are presented. Although metals and metal alloys are featured prominently, some of the items describe tests on a variety of other materials, from concrete to plastics. Many of the tests described are modifications of standard testing procedures, intended either to adapt them to different materials and conditions, or to make them more rapid and accurate. In either case, the approaches presented can result in considerable cost savings and improved quality control. The compilation is presented in two sections. The first deals specifically with material strength testing; the second treats the special category of fracture and fatigue testing. Author

N72-18900# National Aerospace Lab., Tokyo (Japan).
SMALL-STRAIN DEFORMATIONS SUPERPOSED ON FINITE DEFORMATIONS OF HIGHLY ELASTIC AND INCOMPRESSIBLE MATERIALS. PART 1: CONSTITUTIVE EQUATIONS
Tatsuzo Koga Jun. 1971 8 p refs
(NAL-TR-236T-PT-1) Avail: NTIS

A system of linear constitutive equations for a class of deformations added to a known state of finite deformation of thin elastic membranes is derived. Attention is resticted to the class of deformation defined such that lines of curvature of the undeformed membranes remain as lines of curvature in any state of deformation. Strains are assumed small in the additional deformation. The constitutive equations are identical in form to those obtained by Fernandez-Sintes and Nachbar for axisymmetric deformations and to those obtained by Corneliussen and Shield for a circular cylindrical membrane. Author

N72-18901*# National Aeronautics and Space Administration, Washington, D.C.
NASA COMPUTER PROGRAM AIDS AMERICAN DESIGNERS
Donald Zylstra 27 Feb. 1972 7 p
(NASA-News-Release-72-40) Avail: NASA Scientific and Technical Information Facility, P. O. Box 33, College Park, Md. 20740 CSCL 20K

The application of the NASTRAN program to solve civilian structural engineering problems is reported. Results and predicted results of the program's use are included. E.H.W.

N72-18902*# National Aeronautics and Space Administration. Manned Spacecraft Center, Houston, Tex.
A PRELIMINARY STRUCTURAL ANALYSIS OF SPACE-BASE LIVING QUARTERS MODULES TO VERIFY A WEIGHT-ESTIMATING TECHNIQUE NASA General Working Paper
David S. Grissom and William C. Schneider [1971] 139 p refs
(NASA-TM-X-67545; MSC-01542) Avail: NTIS CSCL 13B

The determination of a base line (minimum weight) design for the primary structure of the living quarters modules in an earth-orbiting space base was investigated. Although the design is preliminary in nature, the supporting analysis is sufficiently thorough to provide a reasonably accurate weight estimate of the major components that are considered to comprise the structural weight of the space base. Author

N72-18903*# Grumman Aerospace Corp., Bethpage, N.Y.
DEVELOPMENT AND EVALUATION OF THE IMPULSE TRANSFER FUNCTION TECHNIQUE
M. Mantus Jan. 1972 34 p refs
(Contract NAS1-10635)
(NASA-CR-112025) Avail: NTIS CSCL 20K

The development of the test/analysis technique known as the impulse transfer function (ITF) method is discussed. This technique, when implemented with proper data processing systems, should become a valuable supplement to conventional dynamic testing and analysis procedures that will be used in the space shuttle development program. The method can relieve many of the problems associated with extensive and costly testing of the shuttle for transient loading conditions. In addition, the time history information derived from impulse testing has the potential for being used to determine modal data for the structure under investigation. The technique could be very useful in determining the time-varying modal characteristics of structures subjected to thermal transients, where conventional mode surveys are difficult to perform. Author

N72-18904# Lockheed Missiles and Space Co., Palo Alto, Calif.
STABILITY OF CYLINDRICAL SHELLS OF IMPERFECT SHAPE
I. Ia. Amiro, P. S. Poliakov, and V. G. Palamarchuk [1971] 6 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 7, no. 8, 1971 p 9-16
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The theoretical solution of the stability of a cylindrical shell subjected to compressive stresses distributed uniformly over the endfaces is presented. The coefficients of the series are calculated by known Euler formulas. Hinge support conditions are assured at the shell endfaces. Numerical analyses and mathematical models are included. It is concluded that the experimental value of the critical loading will affect the theoretical value determined when accounting for the actual deviations of the cylindrical shell from an ideal shape. Author

N72-18905# Lockheed Missiles and Space Co., Palo Alto, Calif.
APPLICATION OF THE METHOD OF RANDOM SEARCH IN THE OPTIMAL DESIGN OF CYLINDRICAL SHELLS
Iu. M. Pochtman and G. V. Filatov [1971] 4 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Tverd. Tela

(Moscow), no. 5, 1971 p 199-201
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A procedure for applying the method of random search to compute the minimum weight required for cylindrical shells for specified load conditions is described. The method of random search permits taking into account the geometric restraints imposed on the parameters of the structure being designed. Mathematical models and formulae for expressing the relationships of shell thickness, radius of the middle section, and elastic modulus are presented. Author

N72-18906# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE INVESTIGATION OF THE PLASTIC STABILITY OF CYLINDRICAL SHELLS UNDER COMBINED LOADING
V. S. Gudramovich [1971] 6 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 7, no. 9, 1971 p 25-30
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The relationship between stress resultants and strain increments of shells during buckling in the plastic domain is used to develop a stability criterion for cylindrical shells under combined loading. It is assumed that buckling occurs with the formation of a large number of waves and is presented in the deformation and flow theories as applied to cylindrical shells under loads. G.G.

N72-18907# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF LONGITUDINAL VIBRATIONS OF SPACE VEHICLE BOOSTER CASINGS
B. I. Rabinovich [1971] 5 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Energ. Transp. (USSR), no. 5, 1971 p 104-107
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The perturbed motion of space vehicle booster casings in the longitudinal axis direction is considered, taking into account fluid oscillation in the fuel line, elastic deformation of the casing, and power plant dynamics. Dynamic stability domains are constructed for the closed system with regard to dimensionless structural parameters of the vehicle, and a qualitative analysis of two kinds of instability is given. Author

N72-18908# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF TRANSVERSE VIBRATIONS OF SPACE VEHICLE BOOSTER CASINGS
S. V. Cheremnykh and V. G. Levadnyi [1971] 7 p refs Transl. into ENGLISH from Izv. Akad. SSSR, Energ. i Transp. (Moscow), no. 5, 1971 p 108-113
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The perturbed motion of space vehicle boosters in the yaw plane is examined. The effect of fuel oscillations in the tanks and the resulting elastic deformation of the rocket engine casing is described. The case of frequencies near the elastic casing vibrations is discussed. A qualitiative analysis is given of the mutual influence of elasticity of the booster casing and the mobility of the fuel. Numerical analyses and mathematical models are included. Author

N72-18909*# Boeing Co., Seattle, Wash.
AN EVALUATION OF RANDOM ANALYSIS METHODS FOR THE DETERMINATION OF PANEL DAMPING
Waman V. Bhat and John F. Wilby Feb. 1972 116 p refs
(Contract NAS2-6285)
(NASA-CR-114423) Avail: NTIS CSCL 20K

An analysis is made of steady-state and non-steady-state methods for the measurement of panel damping. Particular emphasis is placed on the use of random process techniques in conjunction with digital data reduction methods. The steady-state methods considered use the response power spectral density, response autocorrelation, excitation-response crosspower spectral density, or single-sided Fourier transform (SSFT) of the response autocorrelation function. Non-steady-state methods are associated mainly with the use of rapid frequency sweep excitation. Problems associated with the practical application of each method are evaluated with specific reference to the case of a panel exposed to a turbulent airflow, and two methods, the power spectral density and the single-sided Fourier transform methods, are selected as being the most suitable. These two methods are demonstrated experimentally, and it is shown that the power spectral density method is satisfactory under most conditions, provided that appropriate corrections are applied to account for filter bandwidth and background noise errors. Thus, the response power spectral density method is recommended for the measurement of the damping of panels exposed to a moving airflow. Author

N72-18910*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
EVALUATION OF THE USE OF A SINGULARITY ELEMENT IN FINITE ELEMENT ANALYSIS OF CENTER-CRACKED PLATES
Alexander Mendelson, Bernard Gross, and John E. Srawley, Washington Mar. 1972 23 p refs
(NASA-TN-D-6703; E-6680) Avail: NTIS CSCL 20K

Two different methods are applied to the analyses of finite width linear elastic plates with central cracks. Both methods give displacements as a primary part of the solution. One method makes use of Fourier transforms. The second method employs a coarse mesh of triangular second-order finite elements in conjunction with a single singularity element subjected to appropriate additional constraints. The displacements obtained by these two methods are in very good agreement. The results suggest considerable potential for the use of a cracked element for related crack problems, particularly in connection with the extension to nonlinear material behavior. Author

N72-18911*# National Aeronautics and Space Administration. Ames Research Center, Moffett Field, Calif.
STRUCTURAL WEIGHT ANALYSIS OF HYPERSONIC AIRCRAFT
Mark D. Ardema Washington Mar. 1972 50 p refs
(NASA-TN-D-6692; A-3905) Avail: NTIS CSCL 20K

The weights of major structural components of hypersonic, liquid hydrogen fueled aircraft are estimated and discussed. The major components are the body structure, body thermal protection system tankage and wing structure. The method of estimating body structure weight is presented in detail while the weights of the other components are estimated by methods given in referenced papers. Two nominal vehicle concepts are considered. The advanced concept employs a wing-body configuration and hot structure with a nonintegral tank, while the potential concept employs an all body configuration and cold, integral pillow tankage structure. Characteristics of these two concepts are discussed and parametric data relating their weight fractions to variations in vehicle shape and size design criteria and mission requirements, and structural arrangement are presented. Although the potential concept is shown to have a weight advantage over the advanced, it involves more design uncertainties since it is farther removed in design from existing aircraft. Author

N72-18912*# Pennsylvania State Univ., University Park. Dept. of Engineering Mechanics.
AN INVESTIGATION OF STRAIN CYCLING BEHAVIOR OF 7075-T6 ALUMINUM UNDER COMBINED STATE OF STRAIN: THE EFFECTS OF OUT-OF-PHASE, BIAXIAL STRAIN CYCLING ON LOW CYCLE FATIGUE
S. Y. Zamrik 5 Jan. 1972 38 p refs
(Grant NGR-39-009-034)
(NASA-CR-72843) Avail: NTIS CSCL 20K

The effect of out-of-phase strain cycling on the low cycle fatigue of biaxially loaded specimens is discussed. A method to apply phase angles between two strains imposed in two different directions was developed. The data and the proposed theoretical analysis are part of a research program on biaxial strain cycling effect on fatigue life of structural materials. Author

N72-18913# Lockheed Missiles and Space Co., Palo Alto, Calif.
CYCLIC SYMMETRIC STRAIN OF SHELLS OF REVOLUTION WITH MERIDIAN RIBS
S. I. Volk [1971] 8 p refs Transl. into ENGLISH from Prikl. Mekh. (Kiev), v. 7, no. 8, 1971 p 16-23
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

Variable-thickness elastic shells of revolution with regularly disposed ribs of varying stiffness are represented in a model as being subjected to symmetrical forces and temperature effects relative to the ribs. An infinite system of ordinary differential equations in amplitude of dispalcement is presented. Numerical methods of integrating differential equations using the computer are considered. As an illustration, a truncated, conical shell of constant thickness and reinforced from the outside by ribs of constant rectangular cross section was computed using the proposed and structurally orthotropic schemes. The method described permits one to approximately account for the discrete disposition of the ribs. The limits of applicability depend on the geometric parameters of the ribbed shell and the nature of the external effects. K.P.D.

N72-18914# Lockheed Missiles and Space Co., Palo Alto, Calif.
ON THE STABILITY OF ECCENTRICALLY REINFORCED SHELLS OF REVOLUTION UNDER AXISYMMETRIC LOADINGS
V. A. Liaskovets and V. I. Miachenkov [1971] 9 p refs Transl. into ENGLISH from Izv. Akad. Nauk SSSR, Mekh. Iverd. Tela (Moscow), no. 5, 1971 p 157-164
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A shell of revolution with a grid of reinforcing elements along the lines of principal curvature was examined. Differential equations and quantities characterizing shell behavior to determine critical loading are presented. A cylindrical waffle shell, loaded by an axial compressive force applied along a circle, was investigated. Two modifications of the disposition of the reinforcing elements were considered: external and internal. K.P.D.

N72-18915# Tulsa Univ., Okla. Dept. of Mechanical-Aerospace Engineering.
ON THE DEFLECTION BEHAVIOR OF ORTHOTROPIC SANDWICH PLATES
Jamal J. Azar and Peter C. Johnson 21 Jan. 1972 29 p refs Backup document for AIAA Synoptic "Deflection of Orthotropic Sandwich Plates", scheduled for publication in AIAA Journal in Jul. 1972
Avail: NTIS

Analytical and experimental studies on the deflection of orthotropic sandwich plates are presented. The analytical phase of the study is based on a previous report. A comprehensive investigation on the deflection patterns of sandwich plates is conducted. The plate is considered to be simply supported and subject to transverse loading only. Various core depths, face sheet thicknesses, and aspect ratios are treated. Experiment has confirmed the theoretical predictions that (1) the maximum deflection of an orthotropic plate subject to a transverse uniform pressure does not necessarily occur at the center of the plate and (2) an upward deflection at some points on the plate surface may occur for a concentrated downward load. Author

N72-18916*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.
TEMPERATURE EFFECTS ON THE STRAINRANGE PARTITIONING APPROACH FOR CREEP-FATIGUE ANALYSIS
G. R. Halford, M. H. Hirschberg, and S. S. Manson 1972 20 p refs Proposed for presentation at Symp. on Fatigue at Elevated Temp., Storrs, Conn., 18-23 Jun. 1972; Sponsored by Am. Soc. for Testing and Mater.
(NASA-TM-X-68023; E-6829) Avail: NTIS CSCL 20K

Examination is made of the influence of temperature on the strainrange partitioning approach to creep-fatigue. Results for Cr-Mo steel and Type 316 stainless steel show the four partitioned strainrange-life relationships to be temperature insensitive to within a factor of two on cyclic life. Monotonic creep and tensile ductilities were also found to be temperature insensitive to within a factor of two. The approach provides bounds on cyclic life that can be readily established for any type of inelastic strain cycle. Continuous strain cycling results obtained over a broad range of high temperatures and frequencies are in excellent agreement with bounds provided by the approach. The observed transition from one bound to the other is also in good agreement with the approach. Author

N72-18917# Technion - Israel Inst. of Tech., Haifa. Dept. of Mechanics.
THE BUCKLING OF BIMODULAR COLUMNS
Z. Rigbi Jan. 1972 24 p refs
(TDM-72-02) Avail: NTIS

The buckling behavior of a column is discussed that is made out of a material which has different elastic moduli in compression and tension, formally equivalent to an elastic-plastic material at the instant of stress-reversal. It is shown that in some cases at least, the modulus in compression provides the criterion for an initial buckling configuration which is stable until a second, less-precisely defined, criterion is reached. Author

N72-18918# Cranfield Inst. of Technology (England). Structural and Aerospace Dynamics Group.
ACTIVE DAMPING IN STRUCTURES
John Roorda Jul. 1971 39 p refs
(Cranfield-Aero-8) Avail: NTIS

The use of active feedback control mechanisms as a means of damping out excess vibrations in modern structural designs, is examined. The basic active damping scheme involves the introduction of a control force on the structure through a feedback network whose input is dictated by the motion of the structure. The feedback network is composed of a sensor, an electro-hydraulic servomechanism and a forcer, and its action in connection with a simple spring mass system is studied. In all nine different control schemes are investigated and their relative merits discussed. An application of the active damping concept is worked out in the Appendix. Author

N72-18919# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
AN APPROXIMATE THEORETICAL STUDY OF THE DYNAMIC PLASTIC BEHAVIOR OF SHELLS
Robert M. Walters and Norman Jones Aug. 1971 48 p refs
(Contract N00014-67-A-0204-0032; NR Proj. 064-510)
(AD-733078; Rept-71-12) Avail: NTIS CSCL 20/1

An approximate theoretical procedure is presented which may be used to estimate the dynamic plastic response of arbitrarily shaped shells. The influence of finite-deflections is retained in the analysis, but material elasticity, strain hardening and strain rate sensitivity are disregarded. The two particular cases of a complete spherical shell which is subjected to a spherically symmetric pressure pulse and a fully clamped cylindrical shell loaded impulsively are considered in some detail. It is observed that the predictions for these two cases agree favorably with the results of more exact rigid-plastic theories. Author (GRA)

N72-18920# Massachusetts Inst. of Tech., Cambridge. Dept. of Ocean Engineering.
AN EXPERIMENTAL STUDY INTO THE DYNAMIC INELASTIC BEHAVIOR OF SPHERICAL SHELLS AND SHELL INTERSECTIONS
Norman Jones, J. G. Giannotti, and K. E. Grassit Aug. 1971 37 p refs

(Contract N00014-67-A-0204-0032; NR Proj. 064-510/12-20-68)
(AD-733079; Rept-71-15) Avail: NTIS CSCL 20/11

An experimental investigation has been conducted into the dynamic inelastic behavior of fully clamped hemispherical shells with and without radially intersecting cylindrical nozzles. The models were subjected to impulsive velocities which were distributed uniformly over the inside surfaces of the shells. Tests were conducted on specimens made from hot rolled mild steel, which is highly strain rate sensitive, and repeated on Aluminum 6061 T6, which is almost strain rate insensitive. Author (GRA)

N72-18921# Stanford Univ., Calif.

BUCKLE CONTOURS IN AN AXIALLY COMPRESSED CIRCULAR CYLINDRICAL SHELL

W. H. Horton and R. W. Johnson Sep. 1971 35 p refs
(Contract DA-44-177-AMC-115(T); DA Proj. 1F1-62204-A-170)
(AD-733374; USAAVLABS-TR-69-29) Avail: NTIS CSCL 20/11

Experimentally determined buckle contours at initial instability for an axially compressed aluminum right circular cylinder of 3.35 inches in diameter and 0.0025 inch of wall thickness are presented and analyzed. The results show that for buckle amplitudes of as low as 2.8 times the wall thickness there is strong evidence of plastic deformation. Author (GRA)

N72-18922# New Mexico Univ., Albuquerque.

FRACTURE MECHANICS IN LOW-CYCLE LOADING AND IN THE PRESENCE OF HIGH STRAIN GRADIENT Final Scientific Report, 1 Feb. 1967 - 30 Jun. 1971

F. D. Ju and Y. C. Hsu Jul. 1971 20 p refs
(Contract AF-AFOSR-0568-67; AF Proj. 9782)
(AD-733415; ME-52(71)AFOSR-074; AFOSR-71-2217TR) Avail: NTIS CSCL 20/11

The fracture criterion for variable low-cycle loading was developed based on the concept of cumulative damage. The study of fracture stability in high strain gradient field is based on the argument that couple-stress becomes significant in such fields. Analytical solutions were initiated leading toward the general solution. Author (GRA)

N72-18923# Illinois Univ., Urbana. Dept. of Civil Engineering.

MEASUREMENT OF STRESS AND STRAIN DURING ONE-DIMENSIONAL COMPRESSION OF LARGE COMPACTED SOIL AND ROCKFILL SPECIMENS Final Report

M. W. C. Emerson and A. J. Hendron, Jr. Sep. 1971 256 p refs
(Contract DACA39-67-C-0023)
(AD-730772; AEWES-CR-S-71-4) Avail: NTIS CSCL 14/2

Research was conducted for the purpose of developing equipment for investigating the static and dynamic stress-strain properties of large-sized granular materials. In addition a limited number of static and dynamic test results are presented on various general backfill materials from three missile sites in the United States. The purpose was to define the stress-strain properties of large-sized granular materials which are frequently used to backfill around protective structures such as missile silos or launch control centers. Author (GRA)

N72-18924# Ballistic Research Labs., Aberdeen Proving Ground, Md.

ELASTIC-PLASTIC CONSTITUTIVE FORMULATIONS FOR MULTI-DIMENSIONAL STRESS STATES INCLUDING NON-ISOTHERMAL PLASTIC DEFORMATION

William J. Gillich Sep. 1971 17 p refs
(AD-733364; BRL-MR-2126) Avail: NTIS CSCL 20/11

A rate-independent elastic-plastic constitutive formulation is presented. It is presented so as to include multi-dimensional stress states and temperature. Indications are included for application in computer codes. An example is given for a specific material in a given technical use. To use this description a thermodynamic equation of state is needed and it must be known which specific stress components are operative. This formulation is based on isotropic work-hardening and the von Mises yield condition. Kinematic work-hardening may be used as well as the Tresca yield condition details of which are given in the references. Author (GRA)

N72-18925# Alabama Univ. Research Inst., Huntsville.

NONLINEAR SHELL THEORIES BY MEANS OF A STATIONARY THEOREM

Gerald A. Wempner Jun. 1971 25 p refs
(Contract F44620-69-C-0124; AF Proj. 9560)
(AD-733411; UARI-RR-110; AFOSR-71-2434TR) Avail: NTIS CSCL 20/11

A general stationary theorem provides the governing equations of a shell theory. Approximations of the displacements, strains and stresses, and the subsequent variations of the two-dimensional fields, produce the equilibrium equations, constitutive equations and the strain-displacement relations of the shell theory. The variational procedure is used to derive a hierarchy of multi-couple theories; the zero couple and one-couple theories are the membrane and bending theories, respectively. Both reduce to accepted approximations under the assumption of plane-stress. The procedure is also employed to obtain a first-approximation which accounts for extension, flexure and transverse shear. The approach provides a simple and direct development of the nonlinear theory for thin elastic shells. Author (GRA)

N72-18926# California Univ., Los Angeles. Dept. of Mathematics.

SPHERICAL SHELLS LIKE HEXAGONS: CYLINDERS PREFER DIAMONDS, PART 1

Charles G. Lange and Alan C. Newell 11 Nov. 1971 48 p refs Prepared in cooperation with Clarkson Coll. of Tech., Potsdam, N. Y.
(Contract N00014-69-A-0200-4022)
(AD-733090) Avail: NTIS CSCL 20/11

The purpose of the paper is to describe the initial postbuckling behavior of cylindrical shells under axial compression. Multiple scale techniques are employed to investigate the dynamic interaction and evolution of competing diamond patterns and the propagation of spatial inhomogeneities. It is shown that if no substanital bias is present in either the initial imperfections or initial conditions, a natural selection mechanism exists which favors the square diamond configuration. Numerical results are included which support the findings of the analytical investigation. Author (GRA)

N72-18927# Naval Civil Engineering Lab., Port Hueneme, Calif.

STRESS ANALYSIS OF MULTICOMPONENT STRUCTURES Final Report, Jul. 1969 - Jun. 1970

S. B. Nossier, S. K. Takahashi, and J. E. Crawford Oct. 1971 44 p refs
(Proj. ZR011-01-01-124)
(AD-733659; NCEL-TR-743) Avail: NTIS CSCL 13/13

In engineering practice, many structures are built with components not monolithically attached to a neighboring component so that slippage along and separation at the contact boundary are possible. The finite element method was utilized to simulate the response of multicomponent structures exhibiting such slippage and/or separation. At mutual boundaries, contact was assumed to be established only for pairs of nodal points or, in general, for sets of nodal points. The condition that slippage or separation occurs at such nodal-point sets when the shear or the tension resistance is exceeded provided the force constraints. Kinematical constraints associated with these force constraints were introduced in the form of binary relations between displacements of nodal-point sets. With the use of the method of Lagrangian multipliers, the total potential energy expression was modified to account for the kinematical constraints. Subroutines necessary to carry out this modification were introduced into an axisymmetric/plane stress program, and a solution was obtained by successive trials. To examine the credibility of the finite element solutions, photoelastic experiments were performed on two-dimensional models of a hatch cover and an airfield-pavement joint. GRA

N72-18928# Naval Research Lab., Washington, D.C.
DETERMINATION OF FIXED BASE NATURAL FREQUENCY OF MULTIPLE-FOUNDATION MECHANICAL SYSTEMS BY SHAKE TEST Interim Report
Chen-Chow Ni and Richard A. Skop 17 Nov. 1971 40 p refs
(RR Proj. 009-03-45-5757; RR Proj. 009-03-45-5807)
(AD-733654; NRL-7300) Avail: NTIS CSCL 13/10

Simple cases were analyzed for a one-dimensional linear chain, and for a dual-foundation shipboard equipment. The report includes the analytical presentation of this method, the physical interpretation of the entities derived, the technical method suggested in taking and analyzing test data and drawing conclusions, and the extension of its application to damped systems, which is of importance in engineering practice. Various computer simulations of a problem designed to illustrate the developed method are provided. Author (GRA)

N72-18929# Army Foreign Science and Technology Center, Charlottesville, Va.
ON USING SIMILARITY CRITERIA TO TEST MATERIALS
V. N. Churakov Oct. 1971 18 p refs Transl. into ENGLISH from Mashinovedenie (USSR), no. 5, 1969 p 61-70
(AD-733616; FSTC-HT-23-530-71) Avail: NTIS CSCL 20/11

The author uses the fundamental assumptions of deformation theory to test several stress hypotheses. The author also surveys several other studies with respect to his formulations. Author (GRA)

N72-18930# Army Foreign Science and Technology Center, Charlottesville, Va.
KINETICS OF CRACK DEVELOPMENT DURING CYCLICAL SOFTENING
N. R. Makhutov 18 Oct. 1971 13 p refs Transl. into ENGLISH from the monograph "Prochnost pri Malom Chisle Tsiklov Nagruzheniya" Moscow, 1969 p 102-109
(FSTC Proj. T7023012301)
(AD-733766; FSTC-HT-23-1030-71) Avail: NTIS CSCL 11/6

Studies of the kinetics of crack development with cyclical softening were performed for low-alloy Cr-Mo-V steel, using both smooth and notched specimens. The results of testing of smooth specimens were used to determine the parameters of the cyclical deformation diagrams for loads with fixed amplitudes of loading and deformation, as well as the types of rupture under these loading conditions. GRA

N72-18931# New Mexico Univ., Albuquerque. Bureau of Engineering Research.
COUPLE-STRESS TO AN INFINITE PLATE BOUNDED BY AN ELLIPTICAL HOLE WITH STATIC EQUILIBRATING TRACTIONS
F. D. Ju, Y. C. Hsu, and W. J. Wang Aug. 1971 37 p refs
(Grant AF-AFOSR-0568-67; AF Proj. 9782)
(AD-733728; ME-51(71)AFOSR-074; AFOSR-71-2216TR) Avail: NTIS CSCL 20/11

Couple-stresses solutions are obtained for an infinite tension elastic plate bounded at the interior by an elliptical hole with the static equilibrating tractions. The nominal tension in the plate is uniform along the minor axis. The selection of the Mathieus: functions and the form of weighting functions in the boundary conditions match a particular class of boundary values which reduces upon limiting processes to three special cases. The first two cases are ones with free stresses on the interior boundary; the couple-stresses solution for the degenerate circle, and the classical solution for the elliptical hole. The third case is the degenerate crack solution with free normal stress and couple stress but non-vanishing shearing stress on the interior boundary. By super-imposing the current solutions on the solutions obtained in another document AFOSR-TR-70-2500 couple-stresses solutions for an infinite elastic plate bounded at the interior by an elliptical hole with the static equilibrating tractions under various biaxial fields of load can easily be obtained. Author (GRA)

N72-18932# British Steel Corp., London (England).
ANALYSIS OF LONG TERM CREEP RUPTURE AND ELEVATED TEMPERATURE YIELD OR PROOF STRESS DATA
P. R. Taylor and R. F. Johnson 1971 15 p refs Presented at meeting on Computational Techniques as an Aid in Phys. Met., Leeds, Engl., Jan. 1971
(PB-202849; BISRA-REP/9/71) Avail: NTIS CSCL 20K

The mathematical problems associated with the extrapolation of long-term creep rupture data and the derivation of realistic minimum properties for elevated temperature tensile data were treated using computerized techniques. A satisfactory method of analyzing large quantities of mechanical test data was developed. Data selection and various mathematical or statistical procedures can readily be applied and the results displayed in either graphs or tables. Operator decisions can guide the course of the analysis at all stages by the use of conversational programming techniques. The original system was expanded to suit a variety of data handling problems in metallurgical and engineering fields and permits a more thorough examination to be made of the factors affecting property levels and their significance. Author (GRA)

N72-18933# Commonwealth Scientific and Industrial Research Organization, Melbourne (Australia). Div. of Forest Products.
A STRUCTURE ANALYSIS OF FRAMES WITH SEMI-RIGID JOINTS (INCLUDING A DESCRIPTION OF A COMPUTER PROGRAM)
G. F. Reardon 1971 21 p refs
(PB-203307; TP-59) Avail: NTIS CSCL 13M

The paper presents a method for analysing a plane framed structure having semi-rigid joints. There are no restrictions as to the degree of redundancy of the structure or of its supports. The stiffness method of analysis, incorporating matrix algebra was used. An iterative process was included to account for the effect of moment change caused by axial loads in deformed members. A comparison between experimental and computed deflections of two timber trusses with semi-rigid joints was made. A description of a computer program based on the theory presented is given. Author (GRA)

N72-18934# Finnish Academy of Technical Sciences, Helsinki.
FATIGUE STUDIED AS A STATISTICAL WORK-HARDENING PHENOMENON
P. Q. Kettunen 1971 25 p refs
(PB-202664; APS-CH-104) Avail: NTIS CSCL 20K

Fatigue is explained on the basis of work-hardening using the ideas of the Statistical Theory of Slip. Work-hardening in copper single crystals was studied under prescribed stress as well as strain amplitudes. A conclusion is drawn that cyclic deformation can be devided into two regions: one in which straining is controlled by cycle hardening by the entire history from the beginning of cycling; the other in which straining is controlled by the instantaneous work-hardening occurring during the half-cycle in question. An eventual fracture seems to require that the yield strength during cycling reaches the value of the dividing stress amplitude between the two regions. Author (GRA)

N72-18935# Naval Research Lab., Washington, D.C.
SCATTERING FROM A PERIODIC CORRUGATED SURFACE. PART 1: SEMI-INFINITE INHOMOGENEOUSLY FILLED PLATES WITH SOFT BOUNDARIES
John A. DeSanto 11 Nov. 1971 36 p refs See also Part 2, N72-18936
(RF Proj. 05-552-402-4070)
(AD-733653; NRL-7320-Pt-1) Avail: NTIS CSCL 20/14

An incident plane wave is scattered from a surface which is corrugated in one dimension and which is described by an infinite number of periodically spaced semi-infinite parallel plates (comb) having soft boundary conditions. An additional plate is placed between each set of adjacent plates, thus dividing the periodicity interval into two regions, one of which doesn't differ in its properties from the region above the plates, while the second region is inhomogeneously filled. The latter means that this region differs in wave-number and density from the surrounding media. Both the wavenumber and the density are here assumed to be constant. The two examples treated in detail are zero-thickness plates with arbitrary incident angle, and arbitrarily thick (inhomogeneous) plates at normal incidence.
Author (GRA)

N72-18936# Naval Research Lab., Washington, D.C.
SCATTERING FROM A PERIODIC CORRUGATED SURFACE. PART 2: SEMI-INFINITE INHOMOGENEOUSLY FILLED PLATES WITH HARD BOUNDARIES Final Report
John A. DeSanto 15 Nov. 1971 20 p refs See also Part 1, N72-18935
(RF Proj. 05-552-402-4070)
(AD-733652; NRL-7321-Pt-2) Avail: NTIS CSCL 20/14

An incident plane wave is scattered from a periodic corrugated surface consisting of semi-infinite parallel plates, alternately filled with density and wavenumber inhomogeneities, having hard (Neumann) boundaries. Amplitude coefficients of the fields in the various regions are related via sets of linear equations, the latter of which are solved using the modified residue calculus technique. The two examples treated are zero-thickness plates with arbitrary incident angle and no inhomogeneity, and normal incidence with alternate sets of plates filled with a constant wavenumber and density inhomogeneity. The edge condition is derived for these inhomogeneous regions.
Author (GRA)

N72-18937# Naval Ship Research and Development Center, Washington, D.C.
ADDED MASS AND DAMPING COEFFICIENTS OF HEAVING TWIN CYCLINDERS IN A FREE SURFACE
C. M. Lee, H. Jones, and J. W. Bedel Aug. 1971 57 p refs
(AD-733985; NSRDC-3695) Avail: NTIS CSCL 13/10

A potential flow problem, dealing with twin horizontal cylinders of arbitrary cross sectional forms vertically oscillating in a free surface is investigated. An associated experiment is carried out for four different sets of twin cylinders. The results from the theory and the experiment are compared and are found in good agreement.
Author (GRA)

N72-18938# Stanford Univ., Calif.
NONSYMMETRIC BUCKLE PATTERNS IN PROGRESSIVE PLASTIC BUCKLING
W. H. Horton, S. C. Bailey, and A. M. Edwards Sep. 1971 39 p refs
(Contract DA-44-177-AMC-115(T); DA Proj. 1F1-62204-A-17)
(AD-733932; USAAVLABS-TR-69-28) Avail: NTIS CSCL 20/11

The report presents the results of a series of tests made on shells which buckled plastically. It is shown that nonsymmetric patterns can be developed. These appear to be nonextensional in character. They are very similar to the Yoshimura pattern which occurs as the bending case for thin shells.
Author (GRA)

N72-18939# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
PROPAGATION OF SINUSODIAL SMALL-AMPLITUDE WAVES IN A DEFORMED VISCOELASTIC SOLID, 2
M. A. Hayes and R. S. Rivlin Sep. 1971 61 p refs
(Contract DAAD05-69-C-0053; Proj. Themis-65)
(AD-733930; CAM-110-20; BRL-CR-53) Avail: NTIS CSCL 20/11

The mean energy flux vector for a plane sinusoidal wave of small amplitude propagating in an isotropic viscoelastic material subjected to an initial static pure homogeneous deformation is calculated. The results are applied to the study of the internal reflection of an SH-wave at the plane surface of a half-space of such material. They are also applied to the reflection-refraction problem at the plane interface between two half-spaces of such materials, subjected to different pure homogeneous deformations.
Author (GRA)

N72-18940# Lehigh Univ., Bethlehem, Pa. Center for the Application of Mathematics.
ENERGY PROPAGATION IN A DEFORMED ELASTIC MATERIAL
M. A. Hayes and R. S. Rivlin Aug. 1971 24 p refs
(Contract DAAD05-69-C-0053; Proj. Themis-65)
(AD-733928; CAM-110-18; BRL-CR-47) Avail: NTIS CSCL 20/11

Resultant material and spatial energy propagation vectors are defined for waves of small amplitude superposed on large static deformations in elastic materials or arbitrary symmetry. It is shown that the resultant material energy propagation vector is in the direction of the normal to the slowness surface and hence in that of the bicharacteristics.
Author (GRA)

N72-18489# Firestone Tire and Rubber Co., Akron, Ohio. Central Res. Labs.
TIRE STRESS AND DEFORMATION
Joseph D. Walter *In* Mich Univ. Mech. of Pneumatic Tires Nov. 1971 p 405-444 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

N72-18490# Michigan Univ., Ann Arbor. Dept. of Engineering Mechanics.
THE CONTACT BETWEEN TIRE AND ROADWAY
Samuel K. Clark *In its* Mech. of Pneumatic Tires Nov. 1971 p 445-499 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

N72-18491# Natural Rubber Producers Research Association, Welwyn Garden City (England).
SKID RESISTANCE AND DIRECTIONAL CONTROL
A. Schallamach *In* Mich. Univ. Mech. of Pneumatic Tires Nov. 1971 p 501-544 refs (See N72-18482 09-15)
Avail: SOD $4.75 as C13.44:122

33 THERMODYNAMICS AND COMBUSTION

Includes ablation, cooling, heating, heat transfer, thermal balance, and other thermal effects; and combustion theory. For related information see also: 12 Fluid Mechanics; and 27 Propellants.

N72-18941# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
TEMPERATURE INFLUENCE ON THE VARIABILITY OF THERMAL AND ELASTIC COEFFICIENTS [INFLUENZA DELLA VARIABILITA DEI COEFFICIENTI TERMICI ED ELASTICI CON LA TEMPERATURA]
P. Santini Dec. 1970 50 p refs In ITALIAN Sponsored by CNR
(Calcolo Elet-12) Avail: NTIS

The effects of variation in thermal diffusivity of a material on temperature distribution were examined for a unidimensional planar body in a transient condition. The influence of variation in thermal coefficients of linear extent, the modulus of elasticity, and the Poisson ratio were investigated with respect to thermal stress. The materials considered were Inconel 600 and Rene 41, both widely used in the aerospace field. The computer program presented may be applied, however, to the examination of thermal behavior of any material whose characteristics are known. Transl. by K.P.D.

N72-18942*# Lockheed Missiles and Space Co., Huntsville, Ala. Research and Engineering Center.
ROCKET EXHAUST PLUME COMPUTER PROGRAM IMPROVEMENT. VOLUME 1: SUMMARY: METHOD OF CHARACTERISTICS NOZZLE AND PLUME PROGRAMS Final Report
Alan W. Ratliff, Sheldon D. Smith, and Norris M. Penny Jan. 1972 137 p refs
(Contract NAS7-761)
(NASA-CR-125601; HREC-7761-1-vol-1; LMSC/HREC-D162220-Vol-1) Avail: NTIS CSCL 21B

A summary is presented of the various documents that discuss and describe the computer programs and analysis techniques which are available for rocket nozzle and exhaust plume calculations. The basic method of characteristics program is discussed, along with such auxiliary programs as the plume impingement program, the plot program and the thermochemical properties program. Author

N72-18943# Rome Univ. (Italy). School of Aerospace Research.
AN EXPERIMENTAL METHOD FOR MEASURING HEAT FLUX IN AERODYNAMIC HYPERSONIC SYSTEMS [UN METODO SPERIMENTALE PER LA MISURA DEI FLUSSI DI CALORE NEGLI IMPIANTI AERODINAMICI IPERSONICI]
Ugo Ponzi Nov. 1970 18 p refs In ITALIAN
(Rept-32) Avail: NTIS

Starting from a theory of conductive heat transfer, an experimental method was obtained for measuring heat transfer rate for models in hypersonic flow. The heat rates can be deduced by measuring the temperature at N points on the model, when N squared coefficients (time functions) are known. These can be obtained experimentally by applying a known heat rate to the model. The method permits heat transfer rates to be obtained directly from temperature measurements, without any particular conditions for the thermal or structural charactertistics of the model. Author

N72-18944# Rome Univ. (Italy). Scuola di Ingegneria Aerospaziale.
GENERAL SOLUTION FOR CALCULATING NONSTATIONARY TEMPERATURE IN AERODYNAMIC HEATING SYSTEMS [SOLUZIONE GENERALE PER IL CALCOLO DELLE TEMPERATURE NON STAZIONARIE NEI RISCALDATORI DEGLI IMPIANTI AERODINAMICI]
Ugo Ponzi Dec. 1970 34 p refs In ITALIAN
(Rept-35) Avail: NTIS

An analytical solution is presented for the problem of convective heat transfer between a fluid flow and a solid heating body with heat adduction in nonsteady conditions. The solution is valid for the study of the transient effects in the heaters of the hypersonic facilities; it applies to both capacity and electrical heaters. The results inferred permit critical aspects in the design of electrical heaters to be pointed out. Author

N72-18945# National Aerospace Lab., Tokyo (Japan).
DIRECT CALCULATION OF SUBLIMATING ABLATION
Hirotoshi Kubota Jun. 1971 25 p refs In JAPANESE; ENGLISH summary
(NAL-TR-239) Avail: NTIS

A direct and rapid calculational method of sublimating ablation for a hypersonic heat-shielding device is presented. This is based on a numerical analysis of the Hartree-Womersley method which reduces parabolic partial differential equation to a corresponding ordinary one by means of a kind of implicit difference. The two-point boundary value problem of non-linear ordinary differential equations for the boundary layer thus obtained by the H-W method is solved with a considerably-improved least square error method. The characteristics of ablation such as the ablation rate and surface temperature are directly and uniquely determined from station to station in the stream wise direction when the conditions of free stream and solid ablator are given. Numerical calculation carried out for Teflon shows that the cooling effectiveness of ablation increases as the free stream stagnation temperature rises and that the downstream distribution of the ablation rate agrees with the experimental data fairly well in the higher range of stagnation temperatures. Author

N72-18946# Advisory Group for Aerospace Research and Development, Paris (France).
HEAT EXCHANGERS
Jean J. Ginoux, ed. Jan. 1972 97 p refs
(AGARD-LS-57) Avail: NTIS

Problems associated with the design, testing, and use of heat exchangers are discussed with respect to compact heat exchangers used in turbine regenerators and aerospace vehicles, heat exchangers in the process and power industries, and heat exchangers with liquid metals. For individual titles, see N72-18947 through N72-18949.

N72-18947# Stanford Univ., Calif.
COMPACT HEAT EXCHANGERS
William M. Kays *In* AGARD Heat Exchangers Jan. 1972 22 p refs (See N72-18946 09-33)
Avail: NTIS

The design and application of heat exchangers employing surface arrangements having the characteristics of very large amounts of surface heat transfer area per unit of volume are considered. Relationships between the friction power expended and the heat transferred are explored, and methods of improving the performance of heat exchanger surfaces are investigated. Heat exchanger design theory, to the extent that it is applicable to very compact exchangers, is reviewed. Data are presented on the heat transfer and friction behavior of a number of very compact surfaces. Author

N72-18948# European Atomic Energy Community, Ispra (Italy). Technology Div.
HEAT EXCHANGE AND HEAT EXCHANGERS WITH LIQUID METALS
R. Nijsing *In* AGARD Heat Exchangers Jan. 1972 61 p refs (See N72-18946 09-33)
Avail: NTIS

Forced convection, liquid metal heat transfer is discussed. The physical principles underlying single phase, liquid metal heat transfer theory is outlined, and the significant developments of the past decade are described. Flow and heat transfer aspects associated with uniform channels (tubes, parallel plates, annuli) are considered first. This provides the ground for a basic discussion of flow and heat transfer in rod bundle geometries and of topics of engineering interest including thermal design of liquid metal cooled nuclear fuel rod assemblies and thermal analysis of liquid metal heat exchangers. Emphasis throughout is on a basic approach. In theoretical considerations particular attention is paid to turbulent transport characteristics in the coolant and to the methodology underlying heat transfer computation procedures. Author

N72-18949# National Engineering Lab., East Kilbride (Scotland).
INDUSTRIAL HEAT EXCHANGERS
D. Chisholm, W. Drummond (Babcock and Wilcox, Ltd., London), and I. Murray *In* AGARD Heat Exchangers Jan. 1972 9 p refs (See N72-18946 09-33)
Avail: NTIS

Various types of heat exchangers used in the process industries are considered. Specifically the design of the following heat exchangers are discussed: shell-and-tube heat exchangers, condensers, evaporators and reboilers, plate heat exchangers, air coolers, cooling towers, evaporative coolers, and direct contact heat exchangers. Author

N72-18950*# Westinghouse Electric Corp., Lima, Ohio. Aerospace Electrical Div.

EVALUATION, CONSTRUCTION AND ENDURANCE TESTING OF COMPRESSION SEALED PYROLYTIC BORON NITRIDE SLOT INSULATION

W. L. Grant Oct. 1969 67 p refs
(Contract NAS3-10941)
(NASA-CR-72849; WAED-69.26E) Avail: NTIS CSCL 20M

A high-temperature statorette, consisting of an iron-27 percent cobalt magnetic lamination stack and nickel-clad silver conductors, was tested with pyrolytic boron nitride slot insulation. Temperatures were measured in each test to determine characteristics of slot linear heat conductance from statorette conductors. Testing was carried out to temperatures of approximately 1500 F in a vacuum environment of 10-8 torr. Three assemblies were built and tested, each having a different room temperature slot clearance. The final statorette assembly was subjected to a 100-hour vacuum aging test at 1400 F followed by 25 thermal cycles. Temperature data from the three assemblies showed that decreasing slot clearance and increasing compression loading did enhance heat transfer. The temperature difference between slot and lamination at 1400 F increased 4 F during the thermal aging and an additional 10 F during the 25 thermal cycles. Author

N72-18951*# Louisiana State Univ., Baton Rouge. Reacting Fluids Lab.

STAGNATION REGION HEATING OF A PHENOLIC-NYLON ABLATOR DURING RETURN FROM PLANETARY MISSIONS Final Report

Donald D. Esch, Ralph W. Pike, Carl D. Engel, Richard C. Farmer, and John F. Balhoff 1 Sep. 1971 488 p refs
(Grant NGR-19-001-059)
(NASA-CR-112026) Avail: NTIS HC $6.00/MF $0.95 CSCL 20M

The results of a stagnation-line analysis of the radiative heating of a phenolic-nylon ablator are reported. The analysis includes flowfield coupling with the ablator surface, equilibrium chemistry, multicomponent or binary diffusion and a coupled line and continuum radiation calculations. Users manual and operating instructions for the computer programs listed in the report are included. Author

N72-18952*# Aerotherm Corp., Mountain View, Calif.

DEMONSTRATION OF THE RANGE OVER WHICH THE LANGLEY RESEARCH CENTER DIGITAL COMPUTER CHARRING ABLATION PROGRAM (CHAP) CAN BE USED WITH CONFIDENCE: COMPARISONS OF CHAP PREDICTIONS AND TEST DATA FOR THREE ABLATION MATERIALS

Carl B. Moyer and Kenneth A. Green Washington NASA Feb. 1972 116 p refs
(Contract NAS1-10136)
(NASA-CR-1980; Rept-71-35) Avail: NTIS CSCL 20M

Comparisons of ablation calculations with the charring ablation computer code and ablation test data are presented over a wide range of environmental conditions in air for three materials: low-density nylon phenolic, Avcoat 5026-39HC/G, and a filled silicon elastomer. Heat fluxes considered range from over 500 Btu/sq ft-sec to less than 50 Btu/sq ft-sec. Pressures range from 0.5 atm to .004 atm. Enthalpies range from about 2000 Btu/lb to 18000 Btu/lb. Predictions of recession, pyrolysis penetration, and thermocouple responses are considered. Recession predictions for nylon phenolic are good as steady state is approached, but strongly transient cases are underpredicted. Pyrolysis penetrations and thermocouple responses are very well predicted. Recession amounts for Avcoat and silicone elastomer are less well predicted, although high heat flux cases near steady state are fairly satisfactory. Pyrolysis penetrations and thermocouple responses are very well predicted. Author

N72-18953# AeroChem Research Labs., Inc., Princeton, N.J.

EVALUATION OF TEST DATA ON JET ENGINE COMBUSTOR BURN-THROUGH FLAMES Final Report, 4 May - 4 Jul. 1971

H. S. Pergament and R. R. Mikatarian Mar. 1972 48 p refs
Prepared for presentation at US Intern. Transportation Exposition, Washington, D. C., 27 May - 4 Jun. 1972
(Contract DOT-FA71NA-575)
(AeroChem-TP-261; FAA-RD-71-100; FAA-NA-72-30) Avail: NTIS

A method was developed to interpret flat plate impingement pressure and temperature data taken in jet engine combustor burnthrough flames in terms of free stream velocities, pressures, temperatures, etc. These flames, which are high temperature, turbulent, underexpanded sonic jets, are caused, in practice, by the combustion gases impinging on (and burning a hole through) the wall of the combustor. Turbulent convective heat transfer coefficients were computed to determine radiation and conduction corrections to the temperature measurements. The influence of mixing between the burnthrough flame and ambient air on flame properties was also studied, and a correlation was developed between the angle of spread of the mixing region and enthalpy flux at the burnthrough hole. Author

N72-18954*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

A STUDY OF THE EFFECT OF SELECTED MATERIAL PROPERTIES ON THE ABLATION PERFORMANCE OF ARTIFICIAL GRAPHITE

Howard G. Maahs Washington Mar. 1972 49 p refs
(NASA-TN-D-6624; L-8085) Avail: NTIS CSCL 20M

Eighteen material properties were measured on 45 different, commercially available, artificial graphites. Ablation performance of these same graphites were also measured in a Mach 2 airstream at a stagnation pressure of 5.6 atm. Correlations were developed, where possible, between pairs of the material properties. Multiple regression equations were then formulated relating ablation performance to the various material properties, thus identifying those material properties having the strongest effect on ablation performance. These regression equations reveal that ablation performance in the present test environment depends primarily on maximum grain size, density, ash content, thermal conductivity, and mean pore radius. For optimization of ablation performance, grain size should be small, ash content low, density and thermal conductivity high, and mean pore radius large. Author

N72-18955*# National Aeronautics and Space Administration. Lewis Research Center, Cleveland, Ohio.

EXPERIMENTAL STUDY OF FLOW DISTRIBUTION AND PRESSURE LOSS WITH CIRCUMFERENTIAL INLET AND OUTLET MANIFOLDS

Ralph T. Dittrich Washington Mar. 1972 53 p refs
(NASA-TN-D-6697; E-6619) Avail: NTIS CSCL 20M

Water flow tests with circumferential inlet and outlet manifolds were conducted to determine factors affecting fluid distribution and pressure losses. Various orifice sizes and manifold geometries were tested over a range of flow velocities. With inlet manifolds, flow distribution was related directly to orifice discharge coefficients. A correlation indicated that nonuniform distribution resulted when the velocity head ratio at the orifice was not in the range of constant discharge coefficient. With outlet manifolds, nonuniform flow was related to static pressure variations along the manifold. Outlet manifolds had appreciably greater pressure losses than comparable inlet manifolds. Author

N72-18956# Lockheed Missiles and Space Co., Palo Alto, Calif.

INFLUENCE OF ALUMINUM AND FERRIC OXIDE ADMIXTURES ON THE VALUE OF THE TEMPERATURE

COEFFICIENT OF THE COMBUSTION VELOCITY OF CONDENSED MIXTURES

V. V. Zhalnin, N. N. Bakhman, G. V. Lukashenia, and Iu. S. Kichin [1971] 3 p refs Transl. into ENGLISH from Fiz. Goren. Vzryva, v. 5, no. 4, 1970 p 429-432
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The effect of aluminum and ferric oxide admixtures, and the combined effect of aluminum and ferric oxide on the temperature coefficient of the combustion rate of ammonium perchlorate mixtures with polystyrene and polymethyl methacrylate was investigated. It is shown that the dependence of combustion rate on initial temperature is weakened when ferric oxide is introduced. The temperature coefficient of combustion rate is reduced correspondingly. K.P.D

N72-18957# Lockheed Missiles and Space Co., Palo Alto, Calif.

MEAN VELOCITY OF POWDER COMBUSTION FOR A HARMONICALLY VARYING HEAT FLUX IN THE FLAME ZONE

I. G. Assovskii and A. G. Zistratov [1971] 5 p refs Transl. into ENGLISH from Fiz. Goreniya Vzryva (USSR), v. 5, no. 4, 1970 p 443-447
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

The problem of powder combustion under the effect of a given periodically time-varying heat flux is studied by considering changes in mean combustion velocity caused by interactions between acoustic waves and the burning solid fuel. It is shown that the mean combustion velocity in the nonstationary mode is less than the stationary velocity in the absence of heat flux for a harmonically varying heat flux in the combustion zone, at all frequencies; as heat flux and combustion velocity change, the quantity of combustion products flowing out of the powder varies and the major portion of the heat flux is expended in heating the additional mass of gas. G.G.

N72-18958# Lockheed Missiles and Space Co., Palo Alto, Calif.

ON THE STABILITY OF COMBUSTION IN A ROCKET CHAMBER

Iu. I. Medvedev [1971] 4 p ref Transl. into ENGLISH from Fiz. Goreniya Vzryva (Novosibirsk), v. 7, no. 1, 1971 p 36-40
Avail: NTIS; National Translations Center, John Crerar Library, Chicago, Ill. 60616

A numerical analysis of the conditions affecting the combustion stability of a rocket engine is presented. The stability of operation of a rocket engine with two kinds of fuel having different burning rates is discussed. Equations of pressure change and gas flow rate are determined. Numerical analyses and mathematical models are included to support the theoretical parameters. Author

N72-18959# Idaho Univ., Moscow. Buchanan Engineering Lab.

INTERNAL TEMPERATURE DISTRIBUTIONS IN AN OPERATIONAL HEAT PIPE

Richard D. Fox, Kelly G. Carothers, and William J. Thomson 10 Mar. 1972 23 p refs Backup document for AIAA Synoptic scheduled for publication in AIAA Journal in July 1972
Avail: NTIS

For the first time in an operational heat pipe, internal temperature distributions are obtained which are subsequently used to analyze the existing energy transport mechanisms. Two basic wick designs and two working fluids (water and methanol) are evaluated over a wide range of power levels and base temperatures. Results indicate that in both wicks and with both fluids a vapor film forms adjacent to the heat pipe wall at the base of the wick. Depending on the wick design and the power level, film boiling occurs and results in superheated vapor blowing through the wick into the vapor section of the pipe. The film thickness and magnitude of superheat are found to be dependent on the wick design, the power level and the saturation pressure. In all cases methanol is shown to be more susceptible to both film formation and film boiling. Despite the large vapor formations in the wick the pipe continues to operate, although not isothermally, without burnout. Speculations are also offered on the burnout mechanisms of heat pipes employing low thermal conductivity fluids. Author

N72-18960*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

HEAT TRANSFER TO FOUR FINENESS-RATIO-1.6 HEXAGONAL PRISMS WITH VARIOUS CORNER RADII AT MACH 6

James L. Hunt Washington Mar. 1972 87 p refs
(NASA-TM-X-2446; L-7934) Avail: NTIS CSCL 20M

An investigation was conducted in the Langley 20-inch Mach 6 tunnel to define the aerodynamic heat transfer to the radioisotope fuel cask (heat source) of the SNAP-19/Pioneer power system. The shape of the SNAP-19/Pioneer heat source is that of a hexagonal prism with flat ends; the fineness ratio, based on maximum (edge to edge) diameter, is 1.61. Phase-change-paint heat-transfer data and schlieren photographs were obtained on four possible 1/2-scale entry configurations of the SNAP-19/Pioneer heat source. Tests were conducted over a wide range of attitudes and at nominal Reynolds numbers, based on the length of the unablated configuration, of 33,000; 84,000; and 2,200,000. Author

N72-18961*# National Aeronautics and Space Administration. Langley Research Center, Langley Station, Va.

COMPUTER PROGRAM OF DATA REDUCTION PROCEDURES FOR FACILITIES USING CO2-N2-O2-Ar EQUILIBRIUM REAL-GAS MIXTURES

Charles G. Miller, III Washington Mar. 1972 61 p refs
(NASA-TM-X-2512; L-8135) Avail: NTIS CSCL 20M

Data reduction procedures for determining free-stream and post-normal-shock flow conditions are presented. These procedures are applicable to flows of CO2, N2, O2, Ar, or mixtures of these gases and include the effects of dissociation and ionization. The assumption of thermochemical equilibrium free-stream and post-normal-shock flow is made. Although derived primarily to meet the immediate needs of an expansion tube of a hot gas radiation research facility, these procedures are applicable to any supersonic or hypersonic test facility using these gases or mixtures thereof. The data reduction procedures are based on combinations of three of the following flow parameters measured in the immediate vicinity of the test section: (1) stagnation pressure behind normal shock, (2) free-stream static pressure, (3) stagnation-point heat-transfer rate, (4) free-stream velocity, and (5) free-stream density. Thus, these procedures do not depend explicitly upon measured or calculated upstream flow parameters. The procedures are incorporated into a single computer program written in FORTRAN IV language. A listing of this computer program is presented, along with a description of the inputs required and a sample of the data printout. Author

N72-18962*# Translation Consultants, Ltd., Arlington, Va.

COMBUSTION IN A HIGH-PRESSURE CHAMBER

V. Pohl and V. Dolezal Washington NASA Mar. 1972 6 p Transl. into ENGLISH from Zprav. VZLU (Litnany, Czech.), no. 6, 1969 p 27-29
(Contract NASw-2038)
(NASA-TT-F-14108) Avail: NTIS CSCL 21B

The process of combustion in a high-pressure chamber is examined to elucidate the problem of the mechanism of fire in an environment of overpressure. Two groups of tests were conducted. In the first group, combustion velocity and intensity were measured at different air pressures and in pure oxygen. In the second group, overpressure and partial vacuum were examined as a function of combustion duration and intensity. Author

N72-18963*# General Electric Co., Bay Saint Louis, Miss. Management and Technical Services Dept.

PYROTECHNIC HAZARDS CLASSIFICATION AND

EVALUATION PROGRAM. ELECTROSTATIC VULNERABILITY OF THE E8 AND XM15/XM165 CLUSTERS, PHASE 1 Final Report

31 Dec. 1970 161 p refs
(Contract NAS8-23524)
(NASA-CR-123038; GE-MTSD-R-052) Avail: NTIS CSCL 19A

A survey of the electrostatic vulnerability of explosive manufacturing plants and recommendations for reducing *the vulnerability are discussed. During the course of the investigations, the XM15/XM165 and the E8 launcher were shown to be susceptible to electrostatic ignition. The pyrotechnic hazard of prime concern associated with electrostatics is that of the spark which can be generated. The heat, shock, and ionization produced by the spark can cause ignition of pyrotechnics. However, as a result of the initial ignition tests (XM15 fuse train), changes have been incorporated to make the fusing system relatively safe from premature electrostatic activation.
Author

N72-18964*# General Electric Co., Bay Saint Louis, Miss.

PYROTECHNIC HAZARDS CLASSIFICATION AND EVALUATION PROGRAM. RUN-UP REACTION TESTING IN PYROTECHNIC DUST SUSPENSIONS Final Report

19 Apr. 1971 60 p refs
(Contract NAS8-23524)
(NASA-CR-123039; GE-MTSD-R-062) Avail: NTIS CSCL 19A

A preliminary investigation of the parameters included in run-up dust reactions is presented. Two types of tests were conducted: (1) ignition criteria of large bulk pyrotechnic dusts, and (2) optimal run-up conditions of large bulk pyrotechnic dusts. These tests were used to evaluate the order of magnitude and gross scale requirements needed to induce run-up reactions in pyrotechnic dusts and to simulate at reduced scale an accident that occurred in a manufacturing installation. Test results showed that propagation of pyrotechnic dust clouds resulted in a fireball of relatively long duration and large size. In addition, a plane wave front was observed to travel down the length of the gallery.
Author

N72-18965*# General Electric Co., Bay Saint Louis, Miss.

PYROTECHNIC HAZARDS CLASSIFICATION AND EVALUATION PROGRAM. PHASE 3, SEGMENTS 1-4: INVESTIGATION OF SENSITIVITY TEST METHODS AND PROCEDURES FOR PYROTECHNIC HAZARDS EVALUATION AND CLASSIFICATION, PART A

19 Apr. 1971 170 p refs
(Contract NAS8-23524)
(NASA-CR-122979; GE-MTSD-R-059-Pt-A) Avail: NTIS CSCL 19A

The findings, conclusions, and recommendations relative to the investigations conducted to evaluate tests for classifying pyrotechnic materials and end items as to their hazard potential are presented. Information required to establish an applicable means of determining the potential hazards of pyrotechnics is described. Hazard evaluations are based on the peak overpressure or impulse resulting from the explosion as a function of distance from the source. Other hazard classification tests include dust ignition sensitivity, impact ignition sensitivity, spark ignition sensitivity, and differential thermal analysis.
Author

N72-18966*# General Electric Co., Bay Saint Louis, Miss. Management and Technical Services Dept.

PYROTECHNIC HAZARDS CLASSIFICATION AND EVALUATION PROGRAM. PHASE 2, SEGMENT 1: RECORDS AND EXPERIENCE ANALYSIS Final Report

Aug. 1970 40 p
(Contract NAS8-23524)
(NASA-CR-122940; GE-MTSD-R-045) Avail: NTIS CSCL 19A

A comprehensive search review and analysis was made of various technical documents relating to both pyrotechnics and high explosives testing, handling, storage, manufacturing, physical and chemical characteristics and accidents and incidents. Of approximately 5000 technical abstracts reviewed, 300 applicable documents were analyzed in detail. These 300 documents were then converted to a subject matrix so that they may be readily referenced for application to the current programs. It was generally concluded that information in several important categories was lacking. Two of the more important categories were in pyrotechnics sensitivity testing and TNT equivalency testing. A general recommendation resulting from this study was that this activity continue and a comprehensive data bank be generated that would allow immediate access to a large volume of pertinent information in a relatively short period of time.
Author

N72-18967*# General Electric Co., Bay Saint Louis, Miss.

INVESTIGATION OF HAZARDS ASSOCIATED WITH PLASTIC BONDED STARTER MIX MANUFACTURING PROCESSES Final Report

May 1971 110 p refs
(Contract NAS8-23524)
(NASA-CR-122977; GE-MTSD-R-064) Avail: NTIS CSCL 19A

An investigation to determine the hazards potential evaluation of plastic bonded starter mix (PBSM) production processes and the application to the M18 and M7A3 grenades is reported. The investigation indicated: (1) the materials with the greatest hazards characteristics, (2) process operating stations most likely to initiate hazardous conditions, (3) the test program required to examine ignition characteristics and process hazards, and (4) the method of handling the accumulated information from testing and safety analyses.
Author

N72-18968*# General Electric Co., Bay Saint Louis, Miss.

PYROTECHNIC HAZARDS CLASSIFICATION AND EVALUATION PROGRAM TEST REPORT. HEAT FLUX STUDY OF DEFLAGRATING PYROTECHNIC MUNITIONS

Paul O. Fassnacht 16 Apr. 1971 77 p
(Contract NAS8-23524)
(NASA-CR-122980; GE-MTSD-R-061) Avail: NTIS CSCL 19A

A heat flux study of deflagrating pyrotechnic munitions is presented. Three tests were authorized to investigate whether heat flux measurements may be used as effective hazards evaluation criteria to determine safe quantity distances for pyrotechnics. A passive sensor study was conducted simultaneously to investigate their usefulness in recording events and conditions. It was concluded that heat flux measurements can effectively be used to evaluate hazards criteria and that passive sensors are an inexpensive tool to record certain events in the vicinity of deflagrating pyrotechnic stacks.
Author

N72-18969*# General Electric Co., Bay Saint Louis, Miss. Management and Technical Services Dept.

PYROTECHNIC HAZARDS CLASSIFICATION AND EVALUATION PROGRAM. PHASE 2, SEGMENT 3: TEST PLAN FOR DETERMINING HAZARDS ASSOCIATED WITH PYROTECHNIC MANUFACTURING PROCESSES Final Report

29 Jan. 1971 73 p refs
(Contract NAS8-23524)
(NASA-CR-122978; GE-MTSD-R-054) Avail: NTIS CSCL 19A

A comprehensive test plan for determining the hazards associated with pyrotechnic manufacturing processes is presented. The rationale for each test is based on a systematic analysis of historical accounts of accidents and a detailed study of the characteristics of each manufacturing process. The most hazardous manufacturing operations have been determined to be pressing, mixing, reaming, and filling. The hazard potential of a given situation is evaluated in terms of the probabilities of initiation, communication, and transition to detonation (ICT). The characteristics which affect the ICT probabilities include the ignition mechanisms which are present either in normal or abnormal operation, the condition and properties of the pyrotechnic material, and the configuration of the processing equipment. Analytic expressions are derived which describe the physical conditions of the system, thus permitting a variety of processes to be evaluated in terms of a small number of experiments.
Author

N72-18970*# General Electric Co., Bay Saint Louis, Miss.
PYROTECHNIC HAZARDS CLASSIFICATION AND EVALUATION PROGRAM. ELECTROSTATIC VULNERABILITY OF THE E8 AND XM15/XM165 CLUSTERS, PHASE 2 Final Report
12 Mar. 1971 188 p refs
(Contract NAS8-23524)
(NASA-CR-123040; GE-MTSD-R-057) Avail: NTIS CSCL 19A

An investigation into the electrostatic phenomena associated with the manufacturing and handling of explosives is discussed. The testing includes measurement of the severity of the primary charge generation mechanism, triboelectric effects between dissimilar surfaces; refinement of equivalent circuits of the XM15/XM165 and E8 fuse trains; evaluation of the electrostatic spark discharge characteristics predicted by an equivalent circuit analysis; and determination of the spark ignition sensitivity of materials, components, jun ctions, and subassemblies which compose the XM15/XM165 and E8 units. Special studies were also performed. These special tests included ignition sensitivity of the complete XM15 fuse train when subjected to discharges through its entire length, measurement of electrostatic potentials which occur during the E8 foaming operation during fabrication, and investigation of the inadvertent functioning of an XM15 cluster during manufacturing. The test results are discussed and related to the effectiveness of suggested modification to reduce the electrostatic ignition sensitivity. Author

N72-18971# Montana State Univ., Bozeman.
NATURAL CONVECTION HEAT TRANSFER BETWEEN A BODY AND ITS SPHERICAL ENCLOSURE Ph.D. Thesis
Norman Weber Dec. 1971 187 p refs
(Contract AT(45-1)-2214)
(RLO-2214-6) Avail: NTIS

Natural convective heat transfer between isothermal vertically eccentric spheres and centrally located vertical cylinders and their isothermal spherical enclosure was experimentally investigated. Pertinent dimensionless parameters and variables were Rayleigh number, based on gap width N sub RA, Prandtl number N sub PR, eccentricity to gap width ratio e/(r - r), gap width to inner radius ratio L/r, and aspect ratio H/2r aub i. Data showed that the eccentricity had a slight effect on the average heat transfer coefficient. The negative eccentricities were found to produce slightly higher average heat transfer coefficents than positive eccentricities. A multicellular flow regime is postulated for the smallest diameter ratio cylinder. Author

N72-18972# Sandia Labs., Albuquerque, N.Mex.
RECENT DEVELOPMENTS IN THE MEASUREMENT OF THERMAL DIFFUSIVITY
R. U. Acton 1971 8 p refs Presented at Ann. Meeting of ASME, Washington, 28 Nov. 1971 Sponsored by AEC
(SC-DC-71-4213; Conf-711112-1) Avail: NTIS

A review is presented of various methods of calculating thermal diffusivity and the rationale behind their use The methods include calculation from thermal conductivity measurements, and periodic and pulsed heat inputs for imposing time-variant temperature signals. K.P.D.

N72-18973# Defense Documentation Center, Alexandria, Va.
NON-DESTRUCTIVE TESTING, ULTRASONICS Report Bibliography, Jan. 1964 - Jan. 1970
Nov. 1971 107 p refs
(AD-733700; DDC-TAS-71-55-1) Avail: NTIS CSCL 14/2

This bibliography is a compilation of references on Non-Destructive Testing: Ultrasonics in a series of bibliographies on Non-Destructive Testing. Citations were selected from entries processed into the Defense Documentation Center's data bank during the period December 1963 through August 1971 and updates an earlier bibliography on Non-Destructive Testing (AD-421 564). Ultrasonic techniques for inspection of welds, thickness measurements, flaw detection, evaluation and characterization of materials, fatigue damage and crack detection are presented. Corporate Author-Monitoring Agency, Subject, Title, and Report Number Indexes are included. Author (GRA)

N72-18974# Naval Ordnance Lab., White Oak, Md.
SMALL CHARGE EXPLOSIONS IN AIR AT HIGH ALTITUDES
Karl Wayne Reed Sep. 1971 56 p refs
(AD-732376; NOLTR-71-171) Avail: NTIS CSCL 19/4

Observations of the luminosity created by 13.5 gram pentolite spheres have been made--primarily in air but also in O2 and N2-- at simulated altitudes of burst from sea level to 100 Kft. The luminosity behavior of these small charges with changes in altitude suggests that the luminosity is primarily created by interactions of the explosion products with the outside atmosphere. No new spectral line or band species are observed, but a broad band of emission does arise with increasing altitude. A second pulse of light is also observed at high altitudes. This second pulse is seen at late times and appears to originate from the core region of the fireball. Author (GRA)

N72-18975# Rochester Univ., N.Y. Dept. of Physics and Astronomy.
NATURE OF THE RESISTANCE ANOMALY NEAR THE FERROMAGNETIC CURIE POINT Ph.D. Thesis
Fredrick C. Zumsteg, Jr. Jul. 1971 147 p refs
(Contract N00014-67-A-0398-0010)
(AD-733414; Tr-2) Avail: NTIS

A comprehensive study of the resistance anomaly at the ferromagnetic Curie point T(c) of Ni, Gd, and GdNi2 is presented. Author (GRA)

N72-18976# Army Foreign Science and Technology Center, Charlottesville, Va.
HEAT TRANSFER DURING BOILING OF FREON-12 INSIDE VERTICAL TUBES
Kh. Ilyasov and K. Taganov Aug. 1971 12 p refs Transl. into ENGLISH from Izv. Akad. Nauk Turkm. SSR, Ser. Fiz.-Tekh., Khim. Geol. (Turkem SSR), no. 5, 1969 p 66-72
(AD-733508; FSTC-HT-23-429-71) Avail: NTIS CSCL 07/4

The purpose of the present paper is experimental study of heat exchange during boiling of freon-12 inside vertical tubes with natural circulation and obtaining the calculation formulas and relations permitting calculation of the local and mean values of the heat transfer coefficient. Author (GRA)

N72-18977# North Carolina State Univ., Raleigh.
ON THE THERMODYNAMIC STATES OF PLASTICALLY DEFORMED SOLIDS
Yasuyuki Horie Dec. 1971 37 p refs
(Contract N00014-68-A-0187; NR Proj. 064-504)
(AD-733991; TR-71-5) Avail: NTIS CSCL 20/12

An argument is presented that the existing difficulties in the thermodynamics of plasticity lie in the overemphasis placed on macro-plastic strains and a particular history associated with it. It is proposed that any plastically deformed states can be adequately represented by an adjacent elastic state constrained with stationary dislocations. Some elementary, but critical, results are obtained including (1) the resolution of Drucker's dilemma concerning the temperature dependence of yield stress and (2) a proof of the path independence of idiabatic deformations in the small. Also a conjecture is offered that the chemical potential may be assigned so as to deal with elastic-plastic transitions. Author (GRA)

N72-18978# Air Force Systems Command, Wright-Patterson AFB, Ohio. Foreign Technology Div.
GAS-DYNAMIC FUNCTIONS OF A POINT EXPLOSION
V. P. Korobeynikov, P. I. Chushkin, and K. V. Sharovatova 8 Sep. 1971 60 p refs Transl. into ENGLISH of the publ. "Gazodinamicheskiye Funktsii Tochechnogo Vzryva" Moscow, Akad. Nauk SSSR Vychislitel'nyy Tsentr, 1969 p 1-48
(AD-733923; FTD-MT-24-995-71) Avail: NTIS CSCL 19/4

The article is dedicated to the problem of a point explosion with counterpressure in a quiescent nonviscous and nonheat-

conducting ideal gas with the constant adiabatic given exponent. Given pressure and density of the undisturbed gas are considered constants. As a result of numerical solution of this problem, tables of the gas-dynamic functions of a point explosion are calculated. This article presents tables for the flat, cylindrical, and spherical explosions in an ideal gas for the given values equal to 1.3, 1.4, and 5/3. The tables contain the basic functions describing the field of the gas flow over a wide time span. Also, some possible applications of these tables for solving other problems in the gas-dynamics of explosion and in hypersonic aerodynamics are explained in the introductory section.
Author (GRA)

34 GENERAL

Includes information of a broad nature related to industrial applications and technology, and to basic research; defense aspects; information retrieval; management; law and related legal matters; and legislative hearings and documents.

N72-18979# Advisory Group for Aerospace Research and Development, Paris (France).
THE 1971 AGARD ANNUAL MEETING
8 Sep. 1971 76 p Conf. held at Torpa, Norway, 8 Sep. 1971
Avail: NTIS

General guidelines for future activities at AGARD are formulated along with research and development activities of the host nation. Norway, as the host nation, presents, its research and development in industrial and defense research. Also given are status and trends in international aerospace cooperation.
E.H.W.

N72-18980# Joint Publications Research Service, Washington, D.C.
TRANSLATIONS ON EASTERN EUROPE: SCIENTIFIC AFFAIRS, NO. 217
4 Feb. 1972 60 p refs Transl. into ENGLISH from various publications of eastern Europe
(JPRS-55111) Avail: NTIS

The serial report contains articles concerning the development of, and progress in, various theoretical and applied scientific disciplines and technical fields, and the administration, structure, personnel, and research plans of leading East European scientific organizations and institutions, particularly the academies of sciences.
Author

N72-18981*# TRW Systems, Houston, Tex.
ANALYSIS OF THE APOLLO SPACECRAFT OPERATIONAL DATA MANAGEMENT SYSTEM. EXECUTIVE SUMMARY
Dec. 1971 27 p
(Contract NAS9-12330)
(NASA-CR-115422; TRW-20029-H006-R0-00) Avail: NTIS CSCL 05C

A study was made of Apollo, Skylab, and several other data management systems to determine those techniques which could be applied to the management of operational data for future manned spacecraft programs. The results of the study are presented and include: (1) an analysis of present data management systems, (2) a list of requirements for future operational data management systems, (3) an evaluation of automated data management techniques, and (4) a plan for data management applicable to future space programs.
D.L.G.

N72-18982*# Computer Sciences Corp., Huntsville, Ala.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MANNED SPACECRAFT CENTER DATA BASED REQUIREMENTS STUDY **Executive Summary**
30 Jul. 1971 27 p
(Contract NAS9-10995)
(NASA-CR-115379) Avail: NTIS CSCL 05B

The results are summarized of a study to determine the requirements of a data management system to meet the needs of MSC in mission planning and program and resource management during the 1975 time frame. The study addresses overall system requirements, implementation considerations, and cost/benefit comparisions.
Author

N72-18983*# Computer Sciences Corp., Huntsville, Ala.
NATIONAL AERONAUTICS AND SPACE ADMINISTRATION MANNED SPACECRAFT CENTER DATA BASE REQUIREMENTS STUDY **Final Report**
30 Jul. 1971 101 p refs
(Contract NAS9-10995)
(NASA-CR-115380) Avail: NTIS CSCL 05B

A study was conducted to evaluate the types of data that the Manned Spacecraft Center (MSC) should automate in order to make available essential management and technical information to support MSC's various functions and missions. In addition, the software and hardware capabilities to best handle the storage and retrieval of this data were analyzed. Based on the results of this study, recommendations are presented for a unified data base that provides a cost effective solution to MSC's data automation requirements. The recommendations are projected through a time frame that includes the earth orbit space station.
D.L.G.

N72-18984*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
THE EFFECTS OF WORK-RELATED VALUES ON COMMUNICATION BETWEEN R AND D GROUPS, PART 1
Ph.D. Thesis
Charles Fowler Douds Aug. 1970 166 p refs Supported in part by Army, NASA, ESSA, and NSF
(NASA-CR-125380; Rept-70/32-Pt-1) Avail: NTIS CSCL 05A

The research concerned with the liaison, interface, coupling, and technology transfer processes that occur in research and development is reported. Overviews of the functions of communication and coupling in the R and D processes, and the theoretical considerations of coupling, communication, and values are presented along with descriptions of the field research program and the instrumentation.
F.O.S.

N72-18985*# Northwestern Univ., Evanston, Ill. Dept. of Industrial Engineering and Management Sciences.
THE EFFECTS OF WORK-RELATED VALUES ON COMMUNICATION BETWEEN R AND D GROUPS, PART 2
Ph.D. Thesis
Charles Fowler Douds Aug. 1970 259 p refs Supported in part by Army, NASA, ESSA, and NSF
(NASA-CR-125381; Rept-70/32-Pt-2) Avail: NTIS CSCL 05A

The methods are presented by which the scales and indicators are combined to provide measures of the variables used in the similarity propositions. These variables are constructs employed to describe the relationships among various phenomena occurring in R and D organizations. The character of these constructs as revealed by the characteristics of the measures derived from response patterns is presented. The reliability and validity of the measures are considered, and test procedures are discussed.
Author

N72-18986# National Bureau of Standards, Washington, D.C. Inst. for Basic Standards.
STANDARD REFERENCE MATERIALS: COMPARISON OF REDOX STANDARDS
K. M. Sappenfield, G. Marinenko, and J. L. Hauge Jan. 1972 99 p refs
(NBS-Spec-Publ-260-24; NBS-SP-260-24) Avail: SOD $1.00 as C 13.10:260-24

The methods used for comparing oxidimetric standard reference materials with each other and for determining the effective purity of these standard reference materials are detailed. The methods, which are modifications of well established and previously published methods, were selected or designed for their accuracy and dependability. An accurate method was devised for the determination of the effective purity of the arsenic trioxide standard SRM 83c by adding solid iodine and determining the excess iodine photometrically.

N72-18987*# National Aeronautics and Space Administration, Washington, D.C.
REMOTE EVALUATION OF REMOTE CONSOLE INFORMATION RETRIEVAL SYSTEM (NASA/RECON)
Victor L. Coles Sep. 1971 29 p refs Presented at Forum on Interactive Bibliographic Systems, Washington, 5 Oct. 1971
(NASA-TM-X-67544) Avail: NTIS CSCL 05B

The technique is described for NASA user evaluation. It consists of sending out an evaluation form with each literature search. The results are presented which are derived from a compilation of user responses. In an eleven-month period in which evaluation forms went out with 3,001 searches, 33.6% of the forms were completed and returned. The returns showed that 88.5% of the respondents found the searches suitable to their needs, 81% learned of valuable new references from the searches, and 93.5% received the searches in time to meet their needs. The significance of relevance or precision ratio in relation to user satisfaction is discussed, and an extrapolation from user responses resulted in a relevance ratio of 49.3%. Some of the general comments found in the responses are analyzed as indicators of what the users expected from the information retrieval service. Author

N72-18988# Smithsonian Institution, Washington, D.C.
SMITHSONIAN YEAR, 1971 Annual Report, 30 Jun. 1971
1971 153 p refs
(Publ-4767) Avail: SOD $1.25 as 4700-0179

Special and continuing activities of the Institution are discussed, and the financial report is presented. Among the special activities are the 1970 Folk Festival on the Mall, Congressional hearings in July 1970, planning for a National Air and Space Museum, planning for the Joseph H. Hirshhorn Museum and Sculpture Garden, and a symposium on cultural styles and social identities interpretations of protest and change. Reports are also given on the scientific museums, institutes, and services; history and art museums and studies; special museum programs; public service activities; and the John F. Kennedy Center for the Performing Arts. N.E.N.

N72-18989*# Techtran Corp., Glen Burnie, Md.
THE TREND OF SPACE PROGRESS
A. D. Ursul Washington NASA Mar. 1972 21 p refs Transl. into ENGLISH from Priroda (Moscow), no. 7, Jul. 1970 p 8-14
(Contract NASw-2037)
(NASA-TT-F-13963) Avail: NTIS CSCL 05D

A philosophical discussion is presented on the change in outlook of mankind toward his surroundings beginning with Copernicus' overturn of the geocentric theory. The cosmization of science and manufacturing activity is considered, along with possible siturations which may be encountered involving the inter-relationship of subject, object, and conditions of observation. The phenomenon of cosmization is a natural outgrowth of man's appreciation of the universe about him. Situations in which the subject, object of observation, and conditions of observation will be extraterrestrial will steadily increase. Situations such as conducting extended studies of objects or phenomena from points outside the earth, and possible exchange of information with extraterrestrial civilizations are mentioned. The day of a purely geocentric approach to science, life, and manufacturing is considered to be gone, never to return. The effect that space exploration has already had on manufactured items and types of jobs is also described. Author

N72-18990# Advisory Group for Aeronautical Research and Development, Paris (France).
AGARD HANDBOOK
Sep. 1971 33 p
(AD-729571) Avail: NTIS CSCL 01/2

The handbook was prepared primarily to serve as an introduction to AGARD, describing what it is and how it works. The By Laws under which AGARD operates are included in the Author Appendix for specific detailed reference purposes. Author (GRA)

N72-18991# Office of Naval Research, London (England).
EUROPEAN SCIENTIFIC NOTES. VOLUME 25, NUMBER 10
John G. Foss, ed. and Victoria S. Hewitson, ed. 31 Oct. 1971 33 p refs
(AD-733063) Avail: NTIS CSCL 05/2

The report is a monthly publication presenting brief articles concerning recent developments in European scientific research. It is hoped that these articles (which do not constitute part of the scientific literature) may prove of value to American scientists by disclosing interesting information well in advance of the usual scientific publications. The articles are on the following: The Netherlands National Aerospace Laboratory; The MRC toxicology unit; The European Pharmacopoeia; Fluidized Bed Zinc-Air Battery Developments; The Institute of Marine Engineers; British Box-Girder Bridges; Electro-Optics at Southampton; Marine Geology at Kiel; The Royal Meteorological Society moved to Bracknell; Bristol Polytechnic, UK; What's new in sintering; Exotic electrodes and pretty pictures at imperial metal industries; Cranfield conference on information retrieval; The International Institute on Computer Science (Proposed); Background and comments on Esfahan Symposium; Bulgarian book bargains. GRA

N72-18992# RAND Corp., Santa Monica, Calif.
TEN GUIDELINES FOR THE SIMULATION OF WEATHER-SENSITIVE MILITARY OPERATIONS: WEATHER AND WARPLANES 2
R. E. Huschke Jun. 1971 36 p refs
(Contract F44620-67-C-0045)
(AD-733559; R-742-PR) Avail: NTIS CSCL 15/7

The report presents directions for quantifying the value of weather service in military operations through the use of computer models. The suggested procedure is: Learn the operation from the operator's viewpoint; Determine acceptable measures of operational effectiveness; Keep the model as simple as credibility allows; Determine the constraints on decision flexibility; Quantify the nonweather decision aspects; Quantify weather effects on each component activity; Determine ways of expressing forecasting skills; Obtain and structure the required weather data, since it is seldom available in the form needed; Establish decision rules and effectiveness criteria; Write credible scenarios for the model. Results from the STRICOM weather/decision model are presented to demonstrate the desirability of the Air Weather Service engaging in such analysis. Author (GRA)

N72-18247# Academy of Sciences (USSR), Moscow.
MANAGEMENT AND RESULTS OF THE PROGRAM COMPLETION
A. A. Aleksandrov, P. A. Artemyev, G. I. Bogatov, I. A. Yelenov, O. G. Ivanov, V. A. Rybkina, Ye. G. Uzkiy, A. I. Shakhov, F. P. Pavlov, Yu. P. Kotlov et al *In its* Lunar Mobile Lab. Lunokhod 1 1971 p 34-54 In RUSSIAN (See N72-18243 09-11)
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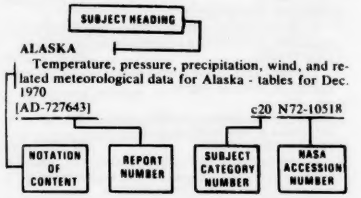

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[NASA-CR-115379] c34 N72-18982
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DEEP SPACE NETWORK
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[NASA-TT-F-14116] c30 N72-18840

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Disk and spherical envelopes of eclipsing binary stars, and relevance of envelopes to study of light curves of eclipsing binaries
[NASA-CR-125630] c30 N72-18825

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[NASA-CR-125658] c04 N72-18064
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EIGENVECTORS
Numerical computation of eigenvalues and eigenfunctions in Orr-Sommerfeld equation for plane Poiseuille flow
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[AD-733928] c32 N72-18940
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[NASA-CR-125610] c12 N72-18280

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[AD-732436] c13 N72-18403

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Bibliography on brittle fracture of steels
[CE-BIB-151.1] c17 N72-18539

Effect of geometric dimensions on fracture toughness of steel and titanium steel alloys
[AD-733655] c17 N72-18560

Fracture mechanics analysis for advanced fiber composites and computerized design of multifastener joints in composites
[NASA-CR-125596] c18 N72-18583

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[AD-733215] c15 N72-18506

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[AD-733420] c03 N72-18055
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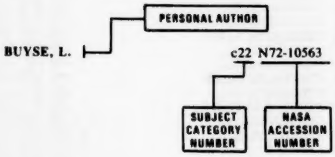

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COOLEY, J. L. c30 N72-18853
COOMBES, H. D. c16 N72-18523
COOPER, E. R., II c24 N72-18710
COPELAND, J. T., JR. c14 N72-18411
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CORONITI, F. V. c13 N72-18384
CORSO, S. J. c02 N72-18017
COULD, C. L. c31 N72-18889
CRABBE, J. S. c07 N72-18161
CRAIG, J. I. c18 N72-18590
CRAVES, R. S. c18 N72-18574
CRAWFORD, J. E. c32 N72-18927
CROSBY, O. A. c13 N72-18346
CROWDER, D., F. c14 N72-18447
CROWDER, M. J. c05 N72-18121
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CRUSE, T. A. c18 N72-18583
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CURTIS, O. L., JR. c26 N72-18747
CURTIS, S. B. c04 N72-18077
CZELNAI, R. c20 N72-18642

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DANILIN, V. P. c21 N72-18662
DAUBER, P. M. c29 N72-18799
c29 N72-18805
DAURIO, A. P. c25 N72-18721
DAVIDSON, R. B. c26 N72-18759
DAVIS, J. E. c22 N72-18677
DAVIS, M. H. c12 N72-18286
DAVIS, R. N. c06 N72-18144
DAVIS, T. N. c20 N72-18646
DAVISON, S. H. c02 N72-18020
DEAN, W. C. c13 N72-18385
DEBRA, D. B. c31 N72-18869
DEDRICK, K. G. c16 N72-18535
DEERWESTER, J. M. c08 N72-18199
DEFIORE, T. A. c14 N72-18468
DEHOLLAND, A. N. c21 N72-18669
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DELUCCHI, E. c24 N72-18713
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DEMETZ, F. C. c12 N72-18296
DEMIRKHANDOV, R. A. c25 N72-18718
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DRAEGER, W. C. c14 N72-18340
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DRENNEN, D. C. c17 N72-18570
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c09 N72-18221
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ECKHARDT, L. c05 N72-18106
ECKHART, D. c13 N72-18315
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ELOY, J. F. c06 N72-18128
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ELSWICK, R. C. c12 N72-18308
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FEDOTOV, S. I. c23 N72-18697
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FRAZER, R. c30 N72-18847
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GREEN, R. N. c30 N72-18828
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GREENE, G. W. c13 N72-18353
GREENE, T. F. c31 N72-18870
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GRELET, N. c04 N72-18072
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GRIGORIN-RIABOV, V. V. c07 N72-18158
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GRISSOM, D. S. c32 N72-18902
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GROSE, W. L. c12 N72-18275
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HALLOW, W. C. c15 N72-18503
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HAMMOND, G. L. c11 N72-18263
HAMMOND, H. K., III c14 N72-18432
HANCOCK. P. c17 N72-18545
HANKE, H. c22 N72-18675
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HANNA, W. D. c17 N72-18554
HARDEBECK, E. G. c30 N72-18854
HARKINS, P. A. c18 N72-18604
HARLOW, R. A. c11 N72-18265
HAROULES, G. G. c20 N72-18641
HARP, J. C. c20 N72-18645
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HARRIS, C. A. c31 N72-18876
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HATCH, W. H. c20 N72-18637
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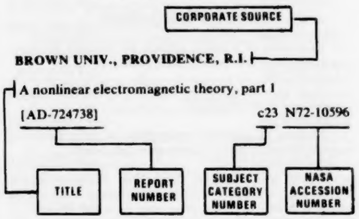

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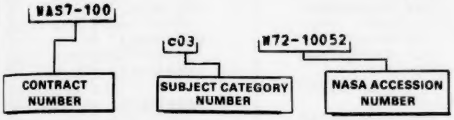

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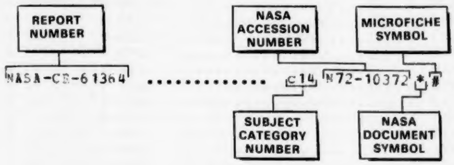

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L-7555 .... c02 N72-18008*#
L-7882 .... c02 N72-18013*#
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L-8047 .... c01 N72-17989*#
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L-8112 .... c02 N72-18012*#
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LA-DC-12996 .... c22 N72-18679*#

LC-68-60042 .... c14 N72-18432 #
LC-70-611535 .... c15 N72-18482 #
LC-73-170325 .... c13 N72-18331*#
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LC-75-180873 .... c17 N72-18551 #
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LR-24792 .... c14 N72-18465 #
LR-25048-VOL-1 .... c02 N72-18024*#
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MCIC-71-01 .... c17 N72-18551 #

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MED-32 .... c26 N72-18751 #

MP-56 .... c15 N72-18500 #

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MS-R-7206 .... c12 N72-18304 #

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NASA-TT-F-14144 .... c15 N72-18499*#
NASA-TT-F-14156 .... c22 N72-18675*#
NASA-TT-F-14157 .... c22 N72-18676*#
NASA-TT-F-14162 .... c25 N72-18716*#
NASA-TT-F-14163 .... c13 N72-18329*#
NASA-TT-F-14165 .... c04 N72-18076*#
NASA-TT-F-14167 .... c12 N72-18288*#
NASA-TT-F-14169 .... c12 N72-18287*#
NASA-TT-F-14170 .... c13 N72-18364*#
NASA-TT-F-14172 .... c05 N72-18110*#
NASA-TT-F-14173 .... c13 N72-18365*#
NASA-TT-F-14174 .... c13 N72-18366*#
NASA-TT-F-14189 .... c23 N72-18686*#
NASA-TT-F-14205 .... c11 N72-18264*#

NAVAIR-50-1C-56 .... c20 N72-18615
NAVAIR-50-1C-57 .... c20 N72-18616

NAVMED-M4306-01-1010BXK9-2 .... c04 N72-18086 #

NAVSTIC-TRANS-3265 .... c28 N72-18790 #

NAVTRADEVCEN-69-C-0322-2	c11	N72-18269 #
NBS-HANDBOOK-109	c09	N72-18215 #
NBS-MN-122	c15	N72-18482 #
NBS-MONOGRAPH-122	c15	N72-18482 #
NBS-MONOGRAPH-123	c14	N72-18429 #
NBS-SP-30-VOL-7	c14	N72-18432 #
NBS-SP-260-24	c34	N72-18986 #
NBS-SPEC-PUBL-260-24	c34	N72-18986 #
NBS-TN-611	c11	N72-18257 #
NBS-TN-703	c18	N72-18592 #
NBS-TN-713	c10	N72-18235 #
NBS-42	c13	N72-18410 #
NBS-10373	c13	N72-18410 #
NCAR-TN/EDD-61	c14	N72-18446 #
NCAR-TN/IA-69	c02	N72-17999 +
NCAR-TN/STR-57	c20	N72-18615
NCAR-TN/STR-58	c20	N72-18616
NCAR-TN/STR-64	c12	N72-18286 #
NCAR-TN/STR-65	c02	N72-18006 #
NCAR-TN/STR-71	c30	N72-18821 +
NCEL-CR-71.010-VOL-2	c15	N72-18510 #
NCEL-TN-1175	c15	N72-18511 #
NCEL-TN-1178	c13	N72-18396 #
NCEL-TR-743	c32	N72-18927 #
NCL-71-29R	c26	N72-18747 #
NELC-TR-1775	c07	N72-18182 #
NLR-TR-69070-U	c01	N72-17993 #
NOAA-TM-NESS-30	c13	N72-18360 #
NOLTR-71-78	c12	N72-18306 #
NOLTR-71-119	c24	N72-18713 #
NOLTR-71-171	c33	N72-18974 #
NOLTR-71-228	c11	N72-18263*#
NOO-IR-71-5	c13	N72-18386 #
NOO-IR-71-13	c13	N72-18409 #
NP-76	c30	N72-18822 #
NP-83	c13	N72-18322 #
NP-18502	c25	N72-18718 #
NP-18505	c25	N72-18717 #
NP-19019	c22	N72-18680 #
NPS-55ZA71081A	c13	N72-18394 #
NPS-57GN71092A	c12	N72-18302 #
NPS-579PY719091A	c15	N72-18507 #
NRC-TT-1505	c12	N72-18282 #
NRC-TT-1509	c26	N72-18741 #
NRC-TT-1516	c10	N72-18236 #
NRC-TT-1518	c26	N72-18740 #
NRC-TT-1519	c04	N72-18073 #
NRC-TT-1523	c26	N72-18742 #
NRC-12433	c15	N72-18500 #
NRL-MR-2366	c25	N72-18723 #
NRL-7294	c13	N72-18376 #
NRL-7300	c32	N72-18928 #
NRL-7318	c07	N72-18166 #
NRL-7320-PT-1	c32	N72-18935 #
NRL-7321-PT-2	c32	N72-18936 #
NRL-7325	c13	N72-18399 #
NRL-7327	c09	N72-18219 #
NRL-7329	c17	N72-18555 #
NRL-7332	c17	N72-18560 #
NSMRL-668	c04	N72-18092 #
NSR-1-3	c03	N72-18053 #
NSRDC-3695	c32	N72-18937 #
NSRDC-3707	c12	N72-18296 #
NSRDC-3731	c07	N72-18167 #
NSRDL/A-8-918	c17	N72-18558 #
NSSDC-70-06	c14	N72-18418*#
NSSDC-70-07	c14	N72-18419*#
NSSDC-70-18	c14	N72-18415*#
NSSDC-71-09	c14	N72-18422*#
NSSDC-71-61A	c14	N72-18417*#
NSTIC-31267	c05	N72-18121 #
NTSB-AAR-72-4	c02	N72-18002 #
NTSR-AAR-72-1	c02	N72-18029 #
NUB-2110	c24	N72-18709 #
NUB-2111	c23	N72-18684 #
NUSC-4189	c12	N72-18308 #
NWC-TP-5235	c01	N72-17995 #
NWL-TR-2645	c08	N72-18209 #
OCD-1211A	c13	N72-18410 #
ONERA-TP-1015	c31	N72-18860
ONRL-C-18-71	c26	N72-18743 #
ONRL-C-20-71	c01	N72-17997 #
ONRL-C-24-71	c24	N72-18711 #
ONRL-R-40-71	c25	N72-18727 #
ONRL-R-42-71	c25	N72-18726 #
ONRL-R-43-7123	c25	N72-18728 #
ORNL-TM-3477	c18	N72-18574*#
OSD-1366	c08	N72-18203 #
OSU-CISRC-TR-71-11	c08	N72-18187 #
OSU-CISRC-TR-71-12	c08	N72-18188 #
OSU-CISRC-TR-72-2	c08	N72-18186 #
OURI-1828-72-1	c14	N72-18457 #
P-695	c13	N72-18398 #
P-741	c07	N72-18174 #
P-4516	c04	N72-18089 #
P-4540	c13	N72-18406 #
P-4587	c02	N72-18031 #
P-4648-1	c19	N72-18610 #
PA-TR-4156	c15	N72-18519 #
PB-201710-F	c02	N72-18034 #
PB-201711-F	c02	N72-18033 #
PB-201938	c05	N72-18117 #
PB-202664	c32	N72-18934 #
PB-202849	c32	N72-18932 #
PB-202995	c04	N72-18091 #
PB-203307	c32	N72-18933 #
PB-203442	c30	N72-18855 #
PB-203443	c30	N72-18856 #
PB-203523	c06	N72-18141 #
PB-203717	c05	N72-18116 #
PB-204035	c02	N72-18035 #
PCD-TR-71-7	c28	N72-18776*#
PC145R8000	c28	N72-18776*#
PH-43-68-666-F	c05	N72-18117 #
PMR-TP-71-4	c13	N72-18404 #
PNE-5013	c13	N72-18375 #
PPG-93	c25	N72-18719*#
PPG-102	c13	N72-18384 #
PR-1-3	c24	N72-18700*#
PR-11	c13	N72-18395 #
PR-50	c24	N72-18701*#
PR-51	c29	N72-18793 #
PR-53	c23	N72-18686*#
PR-54	c30	N72-18837 #

PR-68 .... c19 N72-18606 #
PR-69 .... c14 N72-18428 #
PR-70 .... c30 N72-18836 #

PUBL-C-NO-5 .... c13 N72-18319 #

PUBL-4767 .... c34 N72-18988 #

PWA-4073 .... c03 N72-18055 #

QPR-3 .... c09 N72-18221 #
QPR-26 .... c04 N72-18064*#
QPR-27 .... c04 N72-18063*#

QR-1 .... c14 N72-18466 #
QR-2 .... c27 N72-18765 #
QR-14 .... c06 N72-18135*#

QTR-1 .... c07 N72-18161*#

R-531 .... c19 N72-18614 #
R-534 .... c25 N72-18733 #
R-535 .... c10 N72-18241 #
R-536 .... c25 N72-18734 #
R-537 .... c09 N72-18227 #
R-664-ARPA .... c08 N72-18200 #
R-742-PR .... c34 N72-18992 #
R-802-ARPA .... c11 N72-18274 #
R-852-ARPA .... c20 N72-18635 #
R-7995 .... c12 N72-18292*#
R-8455 .... c12 N72-18292*#
R-1071006 .... c13 N72-18378 #

RADC-TR-71-59 .... c10 N72-18239 #
RADC-TR-71-181 .... c07 N72-18180 #
RADC-TR-71-195 .... c20 N72-18646 #
RADC-TR-71-197 .... c09 N72-18221 #
RADC-TR-71-202 .... c23 N72-18696 #
RADC-TR-71-225 .... c07 N72-18177 #
RADC-TR-71-245 .... c16 N72-18526 #
RADC-TR-71-252 .... c16 N72-18527 #

RAE-LIB-TRANS-1557 .... c15 N72-18501 #

RAE-TR-70142 .... c09 N72-18217 #
RAE-TR-71035 .... c01 N72-17991 #
RAE-TR-71059 .... c11 N72-18265 #

RCS-MEDDH-288(R1) .... c04 N72-18090 #

RD-1102 .... c21 N72-18657*#

RDR-1474-3 .... c18 N72-18579*#

RE-78 .... c21 N72-18674 #
RE-420 .... c23 N72-18683 #
RE-421 .... c08 N72-18198 #

REF-71-6 .... c13 N72-18403 #
REF-71-8-PT-2 .... c13 N72-18379 #

REPT-2WW-TN-71-1 .... c07 N72-18176 #
REPT-5/71 .... c12 N72-18280*#
REPT-7 .... c06 N72-18149 #
REPT-7 .... c14 N72-18413 #
REPT-7 .... c20 N72-18617 #
REPT-7-733-2F .... c15 N72-18479*#
REPT-8 .... c14 N72-18412 #
REPT-12-1970 .... c16 N72-18522 #
REPT-32 .... c33 N72-18943 #
REPT-33 .... c12 N72-18277 #
REPT-34 .... c07 N72-18155 #
REPT-35 .... c33 N72-18944 #
REPT-36 .... c12 N72-18278 #
REPT-37 .... c08 N72-18185 #
REPT-37 .... c19 N72-18605 #
REPT-70/32-PT-1 .... c34 N72-18984*#
REPT-70/32-PT-2 .... c34 N72-18985*#
REPT-71-12 .... c32 N72-18919 #
REPT-71-15 .... c32 N72-18920 #
REPT-71-35 .... c33 N72-18952*#
REPT-71-531-007 .... c23 N72-18687 #
REPT-72-06 .... c07 N72-18171 #
REPT-72-07 .... c21 N72-18663 #
REPT-144 .... c30 N72-18830*#
REPT-1971-12 .... c30 N72-18854 #
REPT-5300-71-20 .... c15 N72-18494*#
REPT-7305-901001 .... c02 N72-18010*#
REPT-7305-903001 .... c02 N72-18011*#

REPT-21605-SR .... c15 N72-18504 #
REPT-034590-1-F .... c29 N72-18795*#
REPT-203296A .... c07 N72-18180 #

RK-TR-71-18 .... c18 N72-18594 #
RK-TR-71-19 .... c16 N72-18533 #

RLO-2214-6 .... c33 N72-18971 #

RM-536 .... c12 N72-18285 #

RP-30 .... c31 N72-18871*#

RPI-TR-MP-24 .... c11 N72-18255*#

RR-TR-71-9 .... c18 N72-18589 #

RR-018 .... c11 N72-18256 #

RRL-LR402 .... c04 N72-18091 #

RR71-15 .... c10 N72-18232*#

RSI-72-02 .... c13 N72-18345*#
RSI-72-03 .... c08 N72-18195*#

R7201-1-VOL-1 .... c08 N72-18193*#
R7201-1-VOL-2 .... c08 N72-18194*#

S-71-1122 .... c09 N72-18225 #

SAD-1970/10(S) .... c13 N72-18367 #
SAD-1970/11(S) .... c13 N72-18369 #
SAD-1970/12(S) .... c13 N72-18368 #

SAM-TR-71-21 .... c04 N72-18095 #
SAM-TR-71-28 .... c04 N72-18087 #
SAM-TR-71-36 .... c05 N72-18123 #

SAMSO-TR-71-191 .... c09 N72-18226 #
SAMSO-TR-71-197 .... c14 N72-18475 #
SAMSO-TR-71-225 .... c30 N72-18857 #
SAMSO-TR-71-230 .... c21 N72-18661 #
SAMSO-TR-71-231-VOL-2 .... c14 N72-18460 #
SAMSO-TR-71-234 .... c18 N72-18597 #
SAMSO-TR-71-255 .... c08 N72-18201 #
SAMSO-TR-71-256 .... c13 N72-18402 #
SAMSO-TR-71-259 .... c06 N72-18139 #
SAMSO-TR-71-260-VOL-2 .... c13 N72-18381 #
SAMSO-TR-71-261-VOL-1 .... c13 N72-18380 #
SAMSO-TR-71-263 .... c13 N72-18401 #
SAMSO-TR-71-265 .... c13 N72-18390 #
SAMSO-TR-71-268 .... c17 N72-18554 #
SAMSO-TR-71-269 .... c13 N72-18393 #
SAMSO-TR-71-274 .... c26 N72-18754 #
SAMSO-TR-71-276 .... c26 N72-18752 #
SAMSO-TR-71-277 .... c26 N72-18753 #

SAO-SPECIAL-REPT-337 .... c30 N72-18839 #
SAO-SPECIAL-REPT-341 .... c29 N72-18794 #

SAO-111-039 .... c29 N72-18794 #

SAPR-15 .... c04 N72-18062*#

SATR-1 .... c14 N72-18474 #
SATR-3 .... c06 N72-18146 #
SATR-4 .... c23 N72-18696 #

SC-DC-71-4213 .... c33 N72-18972 #

SD-71-214 .... c31 N72-18889*#
SD-71-217-1-VOL-1 .... c31 N72-18881*#
SD-71-217-2-VOL-2 .... c31 N72-18882*#
SD-71-217-3-VOL-3 .... c31 N72-18883*#
SD-71-217-4-VOL-4 .... c31 N72-18884*#
SD-71-217-6-VOL-6 .... c31 N72-18885*#
SD-71-217-7-VOL-7 .... c31 N72-18886*#
SD-71-220 .... c31 N72-18890*#
SD-71-221 .... c31 N72-18874*#
SD-71-222 .... c31 N72-18891*#
SD-71-223 .... c31 N72-18873*#
SD-71-225 .... c31 N72-18892*#
SD-71-226-1-VOL-1 .... c31 N72-18887*#
SD-71-226-2-VOL-2-APP .... c31 N72-18888*#
SD-71-293-2-VOL-2 .... c15 N72-18510 #
SD-71-534-1-VOL-1 .... c28 N72-18777*#
SD-71-534-2-VOL-2 .... c28 N72-18778*#
SD-71-534-3-VOL-3 .... c28 N72-18779*#

SER-C-8 .... c20 N72-18618 #

SERG-TR-11 .... c14 N72-18467 #

SNC-3693-2 .... c18 N72-18586 #

SPL-1210 .... c13 N72-18326*#

SR-1 .... c20 N72-18645 #
SR-2 .... c02 N72-18044 #
SR-4 .... c08 N72-18202 #
SR-5 .... c04 N72-18085 #
SR-8 .... c26 N72-18751 #
SR-023-2-SECT-2 .... c30 N72-18855 #
SR-023-3-SECT-3 .... c30 N72-18856 #

SRCC-164 .... c24 N72-18707*#
SRCC-165 .... c24 N72-18706*#

SSC-221 .... c17 N72-18548 #

SSL-SER-13-ISSUE-1 .... c04 N72-18062*#

STI-TR-191-1 .... c05 N72-18125 #

SU-SEL-71-042 .... c20 N72-18645 #

SU-SUDAAR-432 .... c24 N72-18712 #

SUDARR-319 .... c18 N72-18590 #

SWRI-RS-576 .... c14 N72-18469 #
SWRI-RS-577 .... c27 N72-18764 #

T-30 .... c30 N72-18848*#
T-71-20 .... c23 N72-18682*#

TAE-131 .... c12 N72-18293 #

TDM-72-02 .... c32 N72-18917 #

THEMIS-TR-32 .... c19 N72-18611 #
THEMIS-TR-34 .... c19 N72-18612 #

TI-03-71-95 .... c07 N72-18161*#

TM-71-2034-3 .... c07 N72-18159*#
TM-72-1011-1 .... c13 N72-18343*#
TM-72-1011-2 .... c13 N72-18344*#
TM-72-2015-1 .... c29 N72-18796*#
TM-72-2015-2 .... c14 N72-18445*#

TMR-1 .... c18 N72-18591 #

TN-6 .... c20 N72-18628 #
TN-1971-34 .... c07 N72-18181 #
TN-1971-38 .... c06 N72-18144 #
TN-1971-43 .... c07 N72-18179 #

TN23.U7 .... c06 N72-18131 #

TP-59 .... c32 N72-18933 #

TPR-48 .... c27 N72-18761 #
TPR-49 .... c27 N72-18760 #

TR-MD-518 .... c05 N72-18114*#

TR-1 .... c17 N72-18556 #
TR-2 .... c14 N72-18469 #
TR-2 .... c20 N72-18646 #
TR-2 .... c33 N72-18975 #
TR-3 .... c24 N72-18712 #
TR-5 .... c16 N72-18532 #
TR-6 .... c23 N72-18693 #
TR-7 .... c12 N72-18300 #
TR-9 .... c19 N72-18609*#
TR-12 .... c26 N72-18745 #
TR-25 .... c24 N72-18714 #
TR-59 .... c25 N72-18731 #
TR-71-5 .... c33 N72-18977 #
TR-71-07-01 .... c01 N72-17998 #
TR-72 .... c13 N72-18403 #
TR-73 .... c13 N72-18379 #
TR-96 .... c05 N72-18118 #
TR-147-3 .... c21 N72-18656*#
TR-158 .... c08 N72-18190*#
TR-220-1039 .... c31 N72-18877*#
TR-241-1028 .... c13 N72-18359*#
TR-483 .... c16 N72-18525*#
TR-0172(2115)-1 .... c18 N72-18597 #
TR-0172(2158)-1 .... c13 N72-18390 #
TR-0172(2220-10)-2 .... c09 N72-18226 #
TR-0172(2230-20)-5 .... c30 N72-18857 #
TR-0172(2250-3-)-2 .... c08 N72-18201 #
TR-0172(2250-10)-3 .... c17 N72-18554 #
TR-0172(2260-10)-1-VOL-1 .... c13 N72-18380 #
TR-0172(2260-10)-1-VOL-2 .... c13 N72-18381 #
TR-0172(2260-20)-2 .... c13 N72-18401 #
TR-0172(2260-20)-7 .... c13 N72-18393 #
TR-0172(2260-20)-8 .... c13 N72-18402 #
TR-0172(2521-01)-1 .... c21 N72-18661 #
TR-0172(9230-10)-5 .... c26 N72-18752 #
TR-0172(9230-10)-6 .... c26 N72-18753 #
TR-0172(9230-20)-2 .... c26 N72-18754 #
TR-0172(9260-01)-4 .... c06 N72-18139 #
TR-0200(4250-40)-6-VOL-2 .... c14 N72-18460 #

TRW-16402-6012-R0-00 .... c18 N72-18584*#
TRW-17608-6003-R0-00 .... c13 N72-18400 #
TRW-20029-H006-R0-00 .... c34 N72-18981*#
TRW-20266-6006-R0-00 .... c28 N72-18770*#

TSC-FAA-71-3 .... c21 N72-18669 #
TSC-FAA-71-5 .... c21 N72-18670 #
TSC-FAA-71-6 .... c21 N72-18671 #
TSC-FAA-71-7 .... c21 N72-18666 #
TSC-FAA-71-11 .... c02 N72-18043 #
TSC-FAA-71-13 .... c21 N72-18667 #
TSC-FAA-71-17 .... c21 N72-18668 #
TSC-FAA-71-19 .... c20 N72-18641 #

TT-68-50464 .... c07 N72-18163 #
TT-70-50113 .... c30 N72-18827*#

U-4943 .... c06 N72-18146 #
U-4947 .... c06 N72-18141 #

UARI-RR-110 .... c32 N72-18925 #

UC-MET-5-71 .... c17 N72-18557 #

UCLA-ENG-7173 .... c12 N72-18305 #

UILU-ENG-71-2234 .... c19 N72-18614 #
UILU-ENG-71-2237 .... c25 N72-18733 #
UILU-ENG-71-2238 .... c10 N72-18241 #
UILU-ENG-71-2239 .... c25 N72-18734 #
UILU-ENG-71-2240 .... c09 N72-18227 #
UILU-ENG-71-2556 .... c26 N72-18746 #

UM/RAO-71-5 .... c30 N72-18838*#

UPH2-TR-003 .... c17 N72-18559 #

US-PATENT-APPL-SN-7669 .... c31 N72-18859*
US-PATENT-APPL-SN-17101 .... c28 N72-18766*
US-PATENT-APPL-SN-860751 .... c08 N72-18184*
US-PATENT-APPL-SN-889438 .... c15 N72-18477*
US-PATENT-APPL-SN-889556 .... c14 N72-18411*

US-PATENT-CLASS-23-281 .... c28 N72-18766*
US-PATENT-CLASS-23-288 .... c28 N72-18766*
US-PATENT-CLASS-52-108 .... c15 N72-18477*
US-PATENT-CLASS-60-260 .... c28 N72-18766*
US-PATENT-CLASS-95-1.1 .... c14 N72-18411*
US-PATENT-CLASS-178-50 .... c08 N72-18184*
US-PATENT-CLASS-178-66 .... c08 N72-18184*
US-PATENT-CLASS-179-15 .... c08 N72-18184*
US-PATENT-CLASS-235-154 .... c08 N72-18184*
US-PATENT-CLASS-242-54 .... c15 N72-18477*
US-PATENT-CLASS-244-15.5 .... c31 N72-18859*
US-PATENT-CLASS-307-311 .... c14 N72-18411*
US-PATENT-CLASS-340-347DD c08 N72-18184*
US-PATENT-CLASS-346-23 .... c14 N72-18411*
US-PATENT-CLASS-346-107A c14 N72-18411*
US-PATENT-CLASS-352-84 .... c14 N72-18411*

US-PATENT-3,603,093 .... c28 N72-18766*
US-PATENT-3,603,974 .... c14 N72-18411*
US-PATENT-3,603,976 .... c08 N72-18184*
US-PATENT-3,606,212 .... c31 N72-18859*
US-PATENT-3,608,844 .... c15 N72-18477*

USAAMRDL-TR-71-22 .... c02 N72-18038 #

USAARL-72-1 .... c04 N72-18097 #

USAARL-72-2 .... c04 N72-18096 #

USAAVLABS-TR-69-28 .... c32 N72-18938 #
USAAVLABS-TR-69-29 .... c32 N72-18921 #
USAAVLABS-TR-69-2723 .... c18 N72-18590 #

USAFA-RR-71-7-VOL-2 .... c02 N72-18046 #

USAFETAC-TN-71-9 .... c20 N72-18639 #
USAFETAC-TN-71-12 .... c20 N72-18640 #

USGS-IR-NASA-18 .... c14 N72-18449*#
USGS-IR-NASA-67 .... c07 N72-18162*#
USGS-IR-NASA-141 .... c13 N72-18353*#
USGS-IR-NASA-144 .... c13 N72-18352*#
USGS-IR-NASA-145 .... c13 N72-18349*#
USGS-IR-NASA-147 .... c04 N72-18079*#
USGS-IR-NASA-148 .... c13 N72-18354*#
USGS-IR-NASA-150 .... c14 N72-18447*#
USGS-IR-NASA-152 .... c13 N72-18373*#
USGS-IR-NASA-153 .... c13 N72-18350*#
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